# Construction
## Methods and Equipment

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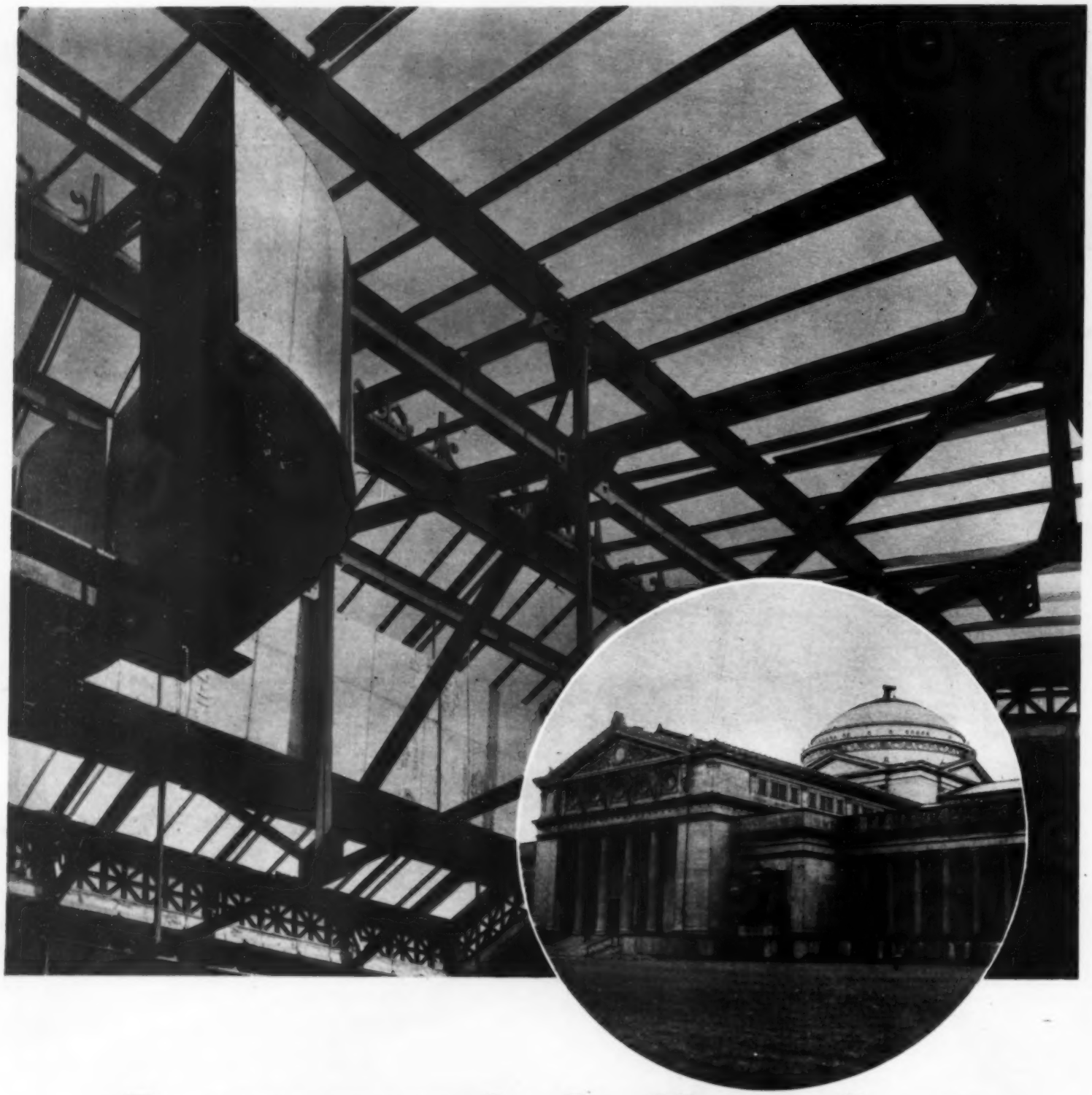

# A museum is built to last

In fact, most buildings are built to last a great many years. But this one has had a peculiar history. Beautifully designed, it was first built of light materials and plaster to last but a few months. Forty years later it was rebuilt—this time for permanence. Inland Galvanized Sheets were chosen for the air ducts because their tight, uniform coating over high quality workable steel permits even difficult forming without surface damage . . . hence adds years of service to the installation.

Fine Arts Building, called most beautiful structure of Chicago's Columbian Exposition in 1893, restored in 1933 as the permanent Museum of Science and Industry. Many tons of Inland Sheets and Reinforcing Bars were used in the restoration.

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# CURRENT JOBS

## . . . . and Who's Doing Them

### BUILDINGS

**Public** — A $3,249,500 contract for U. S. Court House at Philadelphia, Pa., was awarded to **McCloskey & Co.**, of Philadelphia. In Kirkwood (St. Louis), Mo., **Foster & Creighton Co.**, of Nashville, Tenn., are building a $1,100,850 U.S. Marine Hospital. Successful bidder on buildings for cottage farm under General State Authority at Selinsgrove, Pa., was **J. McShain**, of Philadelphia, with a bid of $930,-185. Substructure for 6-story hospital in St. Louis, Mo., was awarded to **Millstone Construction Co.**, of St. Louis, for $647,149. Structural steel contracts for perisphere and trylon buildings, "theme" structures for New York World's Fair 1939, at Flushing, N. Y., were awarded for $612,500 to **American Bridge Co.**, of New York. Under a $577,000 contract, **D. M. W. Contracting Co.**, of Brooklyn, N. Y., is constructing public school in that borough. At Whipple, Ariz., **C. J. Dorfman**, of Los Angeles, bid in for $540,-000 Veterans Bureau hospital. A state fair building at Shreveport, La., went to **A. J. Rife Construction Co.**, of Dallas, Tex., for $516,349. The **J. J. McDevitt Co.**, of Charlotte, N. C., was successful bidder, at $442,560, for a state office building in Raleigh, N. C. A bid of $374,300 obtained a school addition contract in Brookline, Mass., for **Daniel Cunningham Construction Co.**, of Boston. Army officers' quarters at Sacramento, Calif., are being built by **Eaton & Smith**, of San Francisco, for $369,776.

**Commercial** — In suburbs of Cleveland, Ohio, **General Housing Corporation**, of Cleveland, is constructing, under separate contracts, 900 homes to cost $6,750,000. In New Jersey several large housing developments have been started as follows: In Nutley and Bloomfield, by **Brookdale Homes, Inc.**, of Bloomfield, 300 homes to cost $2,100,000; in Summit, by **Commonwealth Land Co.**, of Summit, 175 homes to cost $2,225,000; in Ridgewood, by **L. Gold**, of New York, 100 homes to cost $1,650,000. A $2,-000,000 housing development is under way in Richmond Heights (St. Louis), Mo., by **Manhasset Village Corp.**, of St. Louis. Successful bidders for a $1,500,000 housing development (269 residences) at Grand Island, N. Y., were **Hegeman-Harris Co., Inc.**, of New York City. Low bidder for 18-story hotel in Corpus Christi, Tex., was **E. Oeffinger**, of San Antonio, with a tender of $700,000. General contract for Northeastern University buildings at Boston, Mass., to cost $900,000, went to **Sawyer Construction Co.**, of Boston. For an apartment building in Washington, D. C., to cost $800,000, **Ring Construction Co.**, of Clarendon, Va., was successful bidder. **Marc Eidlitz & Son, Inc.**, are building a $650,000 Presbyterian church parish house in New York City.

**Industrial**—An addition to a power plant in Burlington, N. J., to cost, with equipment, $10,000,000, was awarded to **United Engineers & Constructors**, of Philadelphia. For the Ford Motor Co., of River Rouge, Mich., **Arthur G. McKee & Co.**, of Cleveland, is building a $3,000,000 blast furnace. **Bethlehem Steel Co.** received contract for a $2,000,000 building at Butler, Pa., for American Rolling Mill Co. The **H. K. Ferguson Co.**, of Cleveland, was awarded a $1,000,000 contract for gypsum factory addition at Mobile, Ala. In Milwaukee, Wis., **Klug & Smith**, of Milwaukee, received contract on a $1,000,000 mill and warehouse job. **Koppers Co.** is building $1,000,000 coke ovens at Pueblo, Colo., for Colorado Fuel & Iron Corp. American Rolling Mill Co., at Middletown, Ohio, awarded contract for $1,000,000 steel mill structure to **F. H. McGraw Co.**, of New York City. An $800,000 power plant at Baton Rouge, La., went to **Stone & Webster Engineering Co.**, of New York. In Pittsburgh, Pa., **W. F. Trimble**, of that city, is building a $600,000 newspaper plant for the "Pittsburgh Press."

### SEWERS

In Long Island City, N. Y., the bid of $1,110,750 from **Tully & DiNapoli**, of Long Island City, was low for trunk sewer contract; another low bidder for Long Island sewers was **N. DiMenna & Son**, with a price of $673,875. In Baltimore, **V. Schiavi**, of Baltimore, Md., received $147,145 contract for grit chamber.

### BRIDGES

A big contract, amounting to $4,-846,070, for cables, floor and approach viaducts of Bronx-Whitestone bridge, New York City, was awarded to **American Bridge Co.**, of New York. Another New York bridge contract in the borough of the Bronx drew a low bid of $1,221,427 from **J. Leopold & Co.**, of New York. **National Excavation Corp.**, of New York, bid $768,-350 for substructure of bascule bridge on Queens approach to Bronx-Whitestone bridge, New York. For substructure of Deer Isle bridge, Maine, successful bidder was **Merritt-Chapman & Scott Corp.**, of New York City, with price of $358,765; superstructure went to **Phoenix Bridge Co.**, of New York, for $459,850. Two grade separation structures in Detroit, Mich., were bid in by **W. J. Storen**, of Detroit, for $383,130. At Elizabethport, N. J., **Franklin Contracting Co.**, of Newark, is building two steel bridges for Central Railroad of New Jersey, at cost of $321,255. In San Francisco, **Pacific Bridge Co.**, of that city, received $469,236 contract for track work and contact rail of Bay bridge. Bascule bridge at Galveston, Tex., costing $246,289 is under construction by **Austin Bridge Co.**, of Dallas.

### HIGHWAYS

Important highway contracts were awarded in the following states: New York, elevated highway in New York City, to **James Stewart & Co.**, for $1,204,180; 8.9 mi. in Orange County, to **J. E. Burns**, of Dumont, N. J., for $374,530. Minnesota, 11.6 mi. between Elk River and Anoka, to **McCree & Co.**, of St. Paul and **Phillippi Bros.**, of Minneapolis, for $456,128. New Jersey, 3.7 mi. in Union County to **J. B. Gilligan-Casey Co.**, of Newark, for $322,396. Texas, 10.3 mi. concrete paving in Harrison County to **Austin Road Co.**, of Dallas, for $177,643; 10.3 mi. in Montague County to **Capitol Construction Co.**, of Austin, for $200,-365. Illinois, 9.3 mi. in Perry County to **Granite Bituminous Paving Co.**, of St. Louis, Mo., for $273,007. Missouri, 2.4 mi. in St. Louis County to **Cameron Joyce & Co.**, of Keokuk, Ia., for $259,920. Ohio, 4 mi. of roadside improvement in Wayne County to **C. W. P. Construction Co.** and **Johnson & Johnson**, of Akron, for $253,276. Colorado, 9 mi. gravel surfacing in Ouray County to **H. I. Gardner**, of Glenwood Springs, for $271,792. Iowa, 9 mi. concrete paving in Calhoun County to **J. S. McLaughlin & Sons**, of Des Moines, for $230,376. Maryland, 4.8 mi. concrete paving in Anne Arundel County to **C. J. Langenfelder Sons**, of Rosedale, Md. Mississippi, 12 mi. in Hancock County to **Harrison Engineering & Construction Co.**, of Kansas City, Mo., for $263,681.


# Construction Methods and Equipment



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WILLARD CHEVALIER, Vice-President

**NOVEMBER, 1937**


## The "How" of it

*For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:*


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ROBERT K. TOMLIN, Editor — A. E. PAXTON, Manager

*Editorial Staff*: Vincent B. Smith, John B. Huttl (San Francisco), Paul Wooton (Washington), Nelle Fitzgerald

# Can We Steady Construction?

WHENEVER construction men begin to talk about their labor problems, two subjects always stick their heads up: shortage of skilled workmen and seasonal employment.

For some time this writer has had in mind to button up these two ideas and offer the combination as a single problem deserving the best thought of the industry. But now someone else has done the job in excellent style. So right here he yields the floor to *"The Central Constructor,"* bulletin of the Central Branch of the A.G.C., and offers the following extracts from its issue of 23 September.

"Construction suffers from the fact that it is seasonal — this being still true of a large part of its operations, despite advances during recent years toward adoption of methods and materials which make possible the extension of operations over a longer period of the twelve months.

"But it is not only the ownership of the industry which pays for the seasonal character of the business. Its employees pay and the public pays.

"Construction pays through being unable to secure for brief and interrupted periods of employment the higher quality of labor which would be attracted to steady and lasting jobs. It pays in labor turnover and in labor discontent, both of them inescapably reflected in the overhead.

"Construction labor's disadvantage is obvious. The workman signs on when and where he can find a job, holds it until it is completed, and all too frequently has to start his search for another job all over again after each project. When the winter shuts down many phases of construction, he can't find a job no matter how good a man he is.

"The public's loss is in the necessity of supporting the jobless, in one way or another, and in the higher prices imposed upon it by the contractor's higher costs of performance, which in their turn trace back to seasonalism.

* * * *

"There is a significance in this situation that is important to every contractor who takes the long term view of his own business.

"The industry needs workers and for two years has had experience with a shortage particularly acute in the field of skilled workmen. Yet in spite of this shortage but little has been or is being done to encourage men to enter construction as a life work.

"The youth outside looking at it as a prospect for himself must observe that the industry is already too careless of the loyalty of the men within it. Too little is being done for the faithful employee who has served the industry well in the past, to make the prospects inviting to the younger man looking for a vocation.

* * * *

"If the public expects the contractor to carry his men through the winter or through any other interruption of regular employment there is only one source of the funds which will do it. That money has to come from the price paid for construction. And that means that it must be included in the prices bid by the contractor.

"The contractor need not, however, expect to include in his bids a double item for labor in order to be able to pay a six-months' employee throughout the year. Owners would balk.

"A part of that cost must go into the bid. The rest the contractor must expect to pay because it is earned. And it can be earned in the winter, in many cases, as well as in the summer.

"Much construction activity can be shifted as to season, and new activities can be devised for valuable men. Contractors can make provision for improving their men. Many can be made more valuable, to themselves and to their employers, by additional training in construction methods. They can be taught safety, equipment repair, maintenance, study of specifications, waste elimination, cooperation with architects, engineers, owners and the public, etc. They can be made to feel themselves a part of the contractor's organization instead of temporarily attached to it.

"Foremen and skilled machine operators can be taken from the ranks of the workmen and made to secure better results than could the stranger brought in from the outside and given a post that long time employees could easily be made able to fill."

So there it is — stated by one group of contractors and hereby passed on for the consideration of the industry as a whole.

Willard Chevalier

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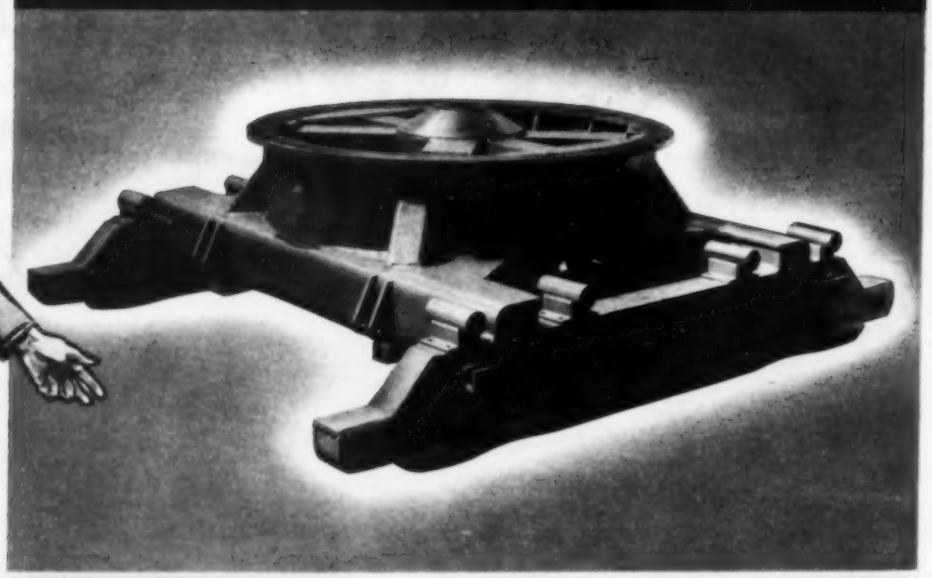
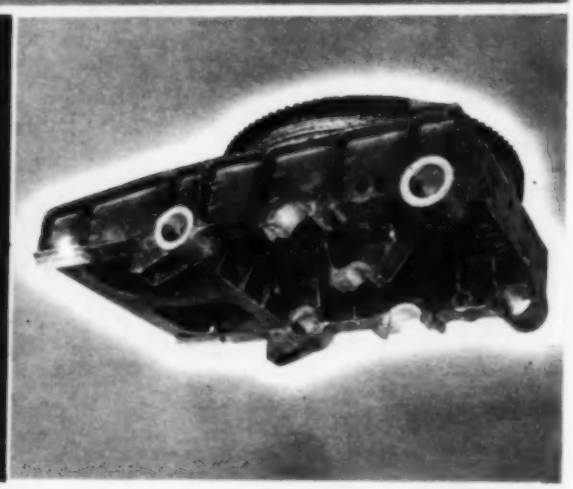


ABOVE: Modern P & H carbody, a rigid, welded unit of tough alloy steels.

RIGHT: Old type carbody: made of clumsy castings bolted together—



## P.H Pacemakers-FASTER ON THE JOB

● Here, in a nutshell, is the story of all-welded excavator construction with alloy steels. At the bottom is an old type carbody . . . it is cast . . . subject to cracking under strain . . . its actual strength is never known. . . . Above is the new type P&H carbody, made of tough rolled steels. Every inch of its uniform cross-sectional strength is accurately predetermined. The welds are actually stronger than the parent metal itself. This new carbody eliminates a good 25% dead weight, reduces ground pressure, costs less to run, less to maintain. The excavator industry will gradually adopt this more practical design. For information on P&H excavators from 3/8 to 5 cu. yds. capacity, address the Harnischfeger Corp., 4494 W. National Ave., Milwaukee, Wis.

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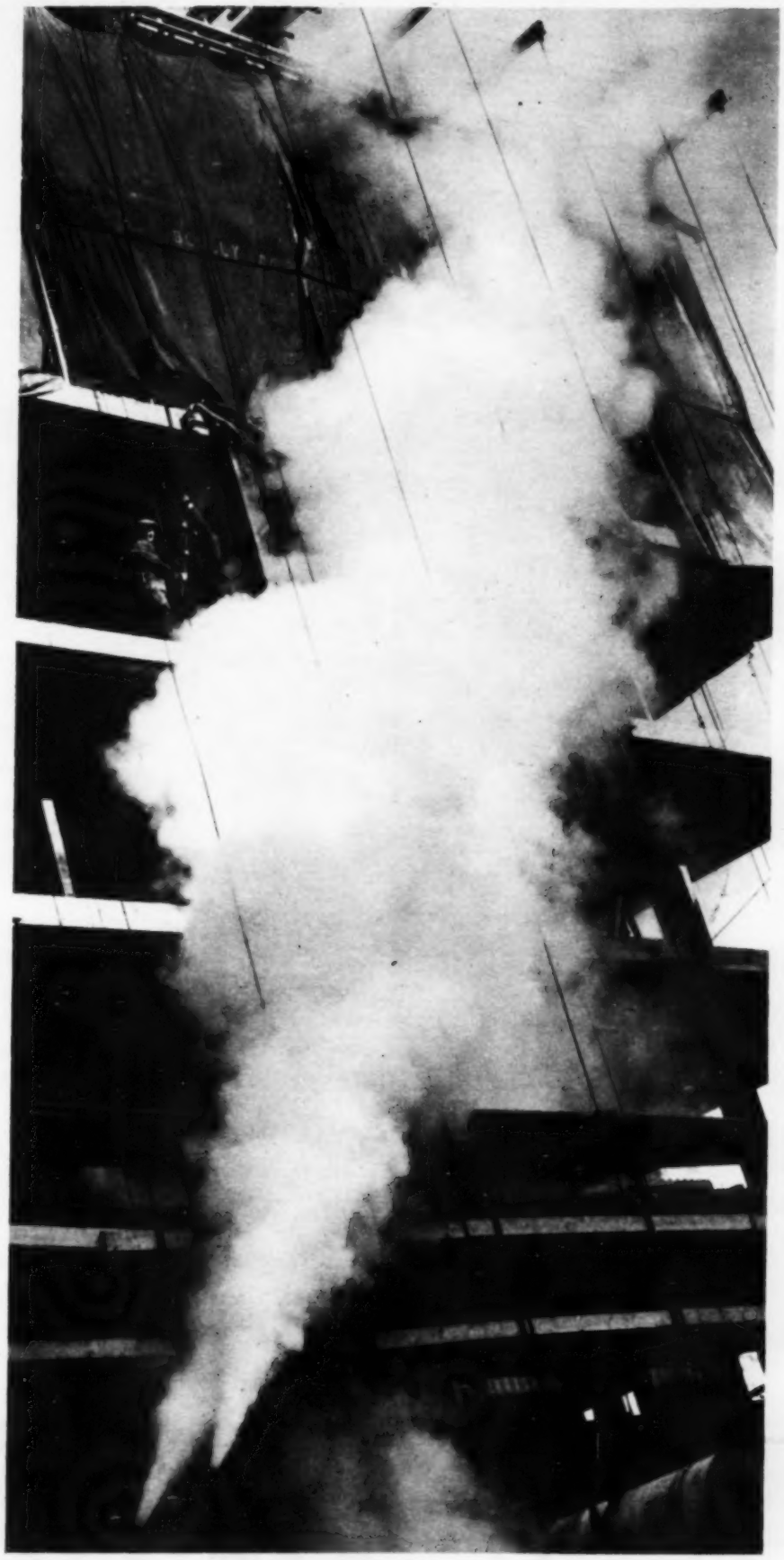
# WINTER'S COMING

## PLAN NOW TO CUT CONCRETING COSTS WITH 'INCOR'



IN Winter, more than at any other time, it pays to develop high concrete strengths at early periods. Heat-curing, form requirements and frost hazard are thereby reduced to a minimum — lower costs and rapid construction progress result. Reason:

Concrete hardens through chemical reaction between Portland cement and water. At 70° or above, this reaction takes place normally. As concrete temperature falls, the reaction is retarded; at or about freezing, it practically stops.

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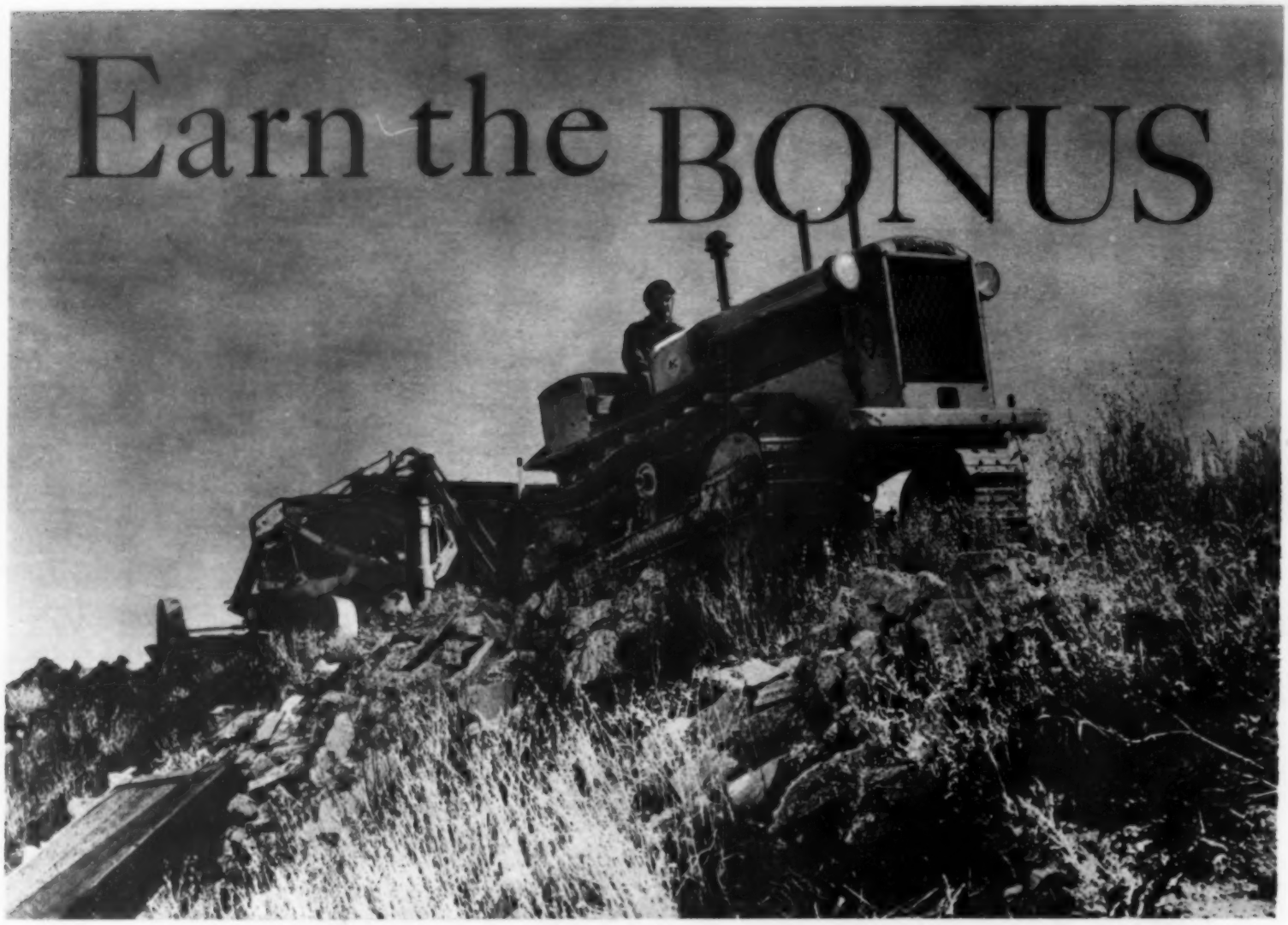


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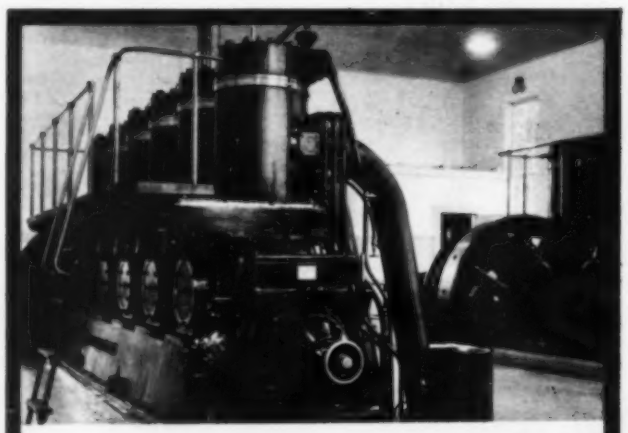

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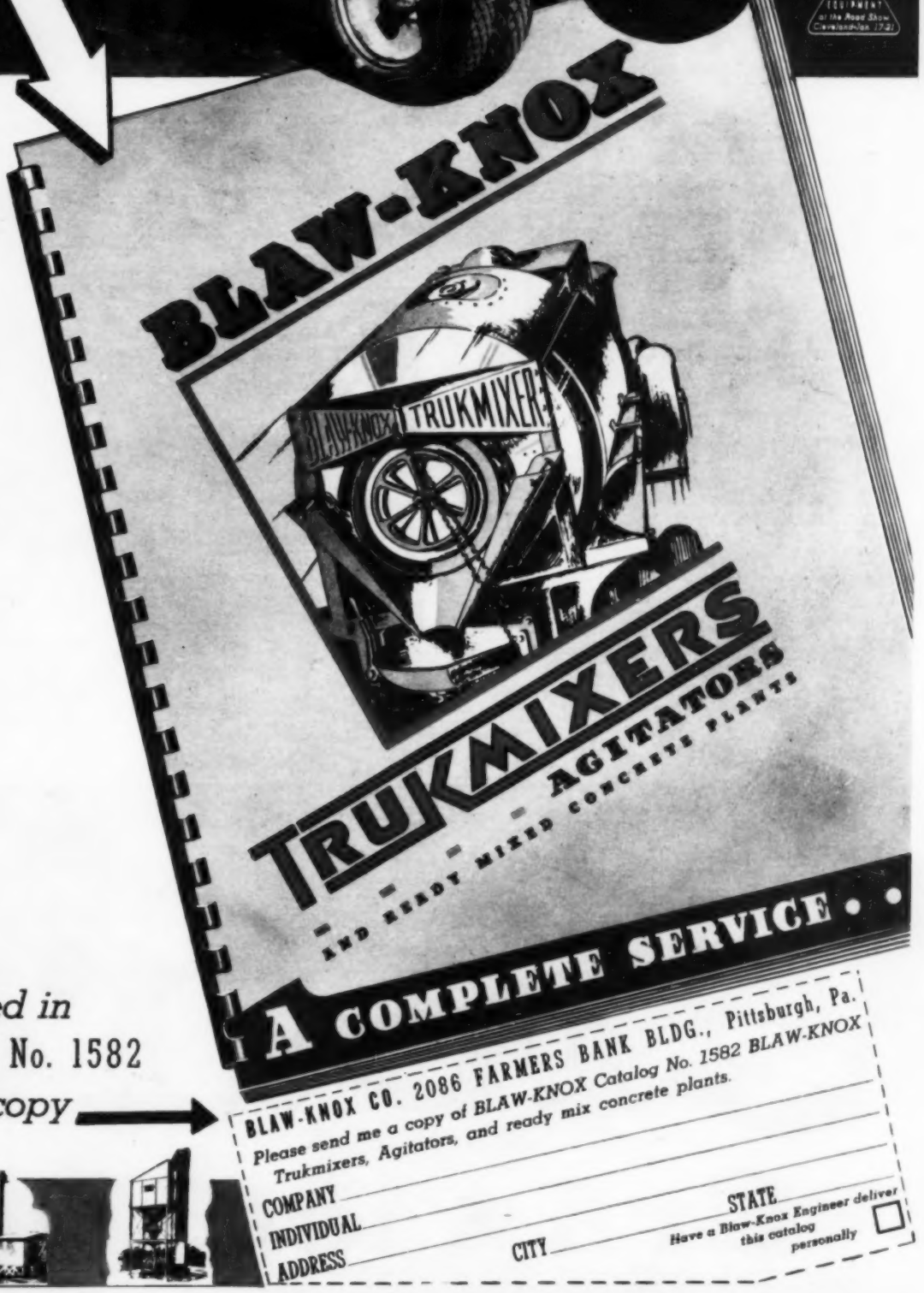


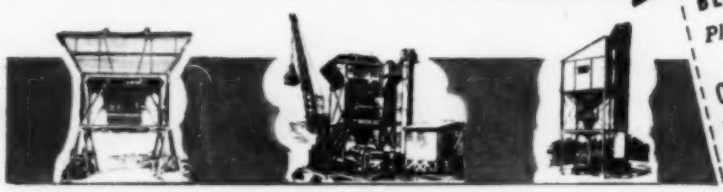

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(Left) One of a gang of Cletracs building the approach from the Golden Gate International Exposition Grounds to the San Francisco Bay Bridge. When big jobs need doing, Cletracs do them.

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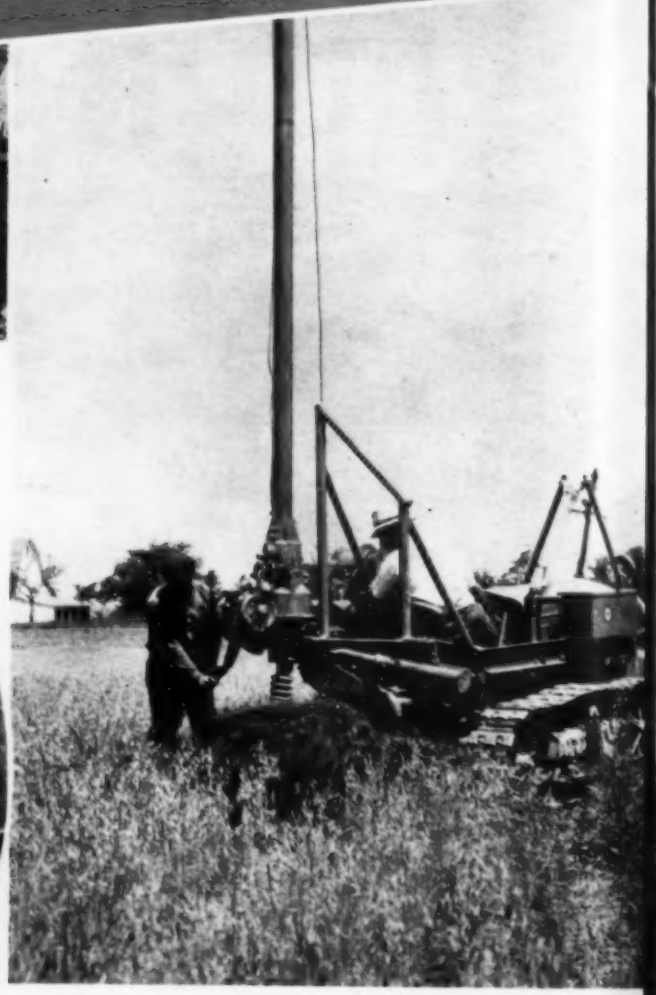

(Left) Hauling heavy materials on the job . . . getting them quickly from one place to another, is another of the things you can do with a Cletrac.

(Above) Dig post holes for guard rails, for rural electrification lines, for telephone lines at lower cost with a Cletrac and post hole digger. This outfit will dig a 36-inch hole, 10 feet deep, in from 4 to 10 minutes.

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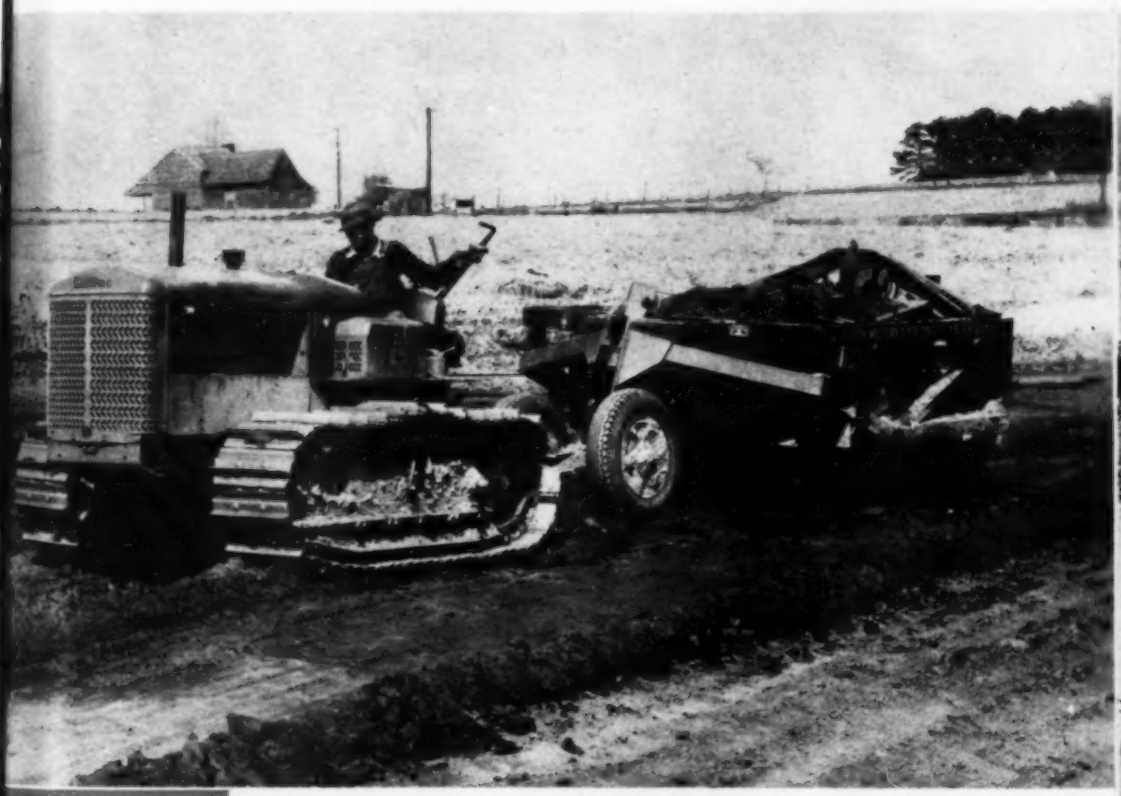
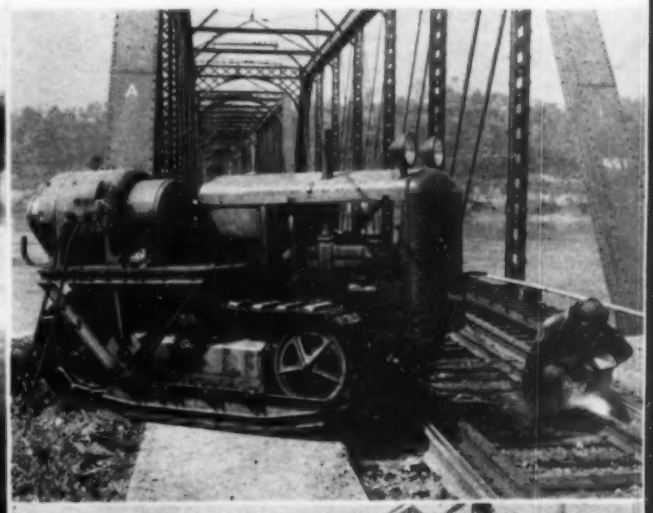
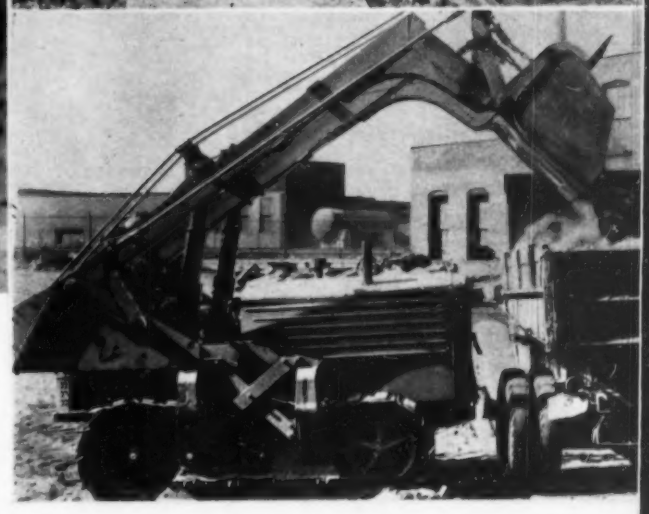
**Furthermore, Cletracs handle the same going downhill when the load is pushing as well as when the tractors are pulling — another reason for choosing the tractor with controlled differential steering.**

**There are other features about the Cletrac you'll like. Check them all. Then have a demonstration on your own job under your own conditions.**

## The Cleveland Tractor Company, Cleveland, Ohio







(Above) One of a pair of Cletrac Model DD Diesels in Hart County, Georgia, that is moving from 50 to 75 yards of dirt per hour per unit, depending upon the length of the haul.

(Below right) This Cletrac and front end loader picks up ¾ of a yard of material at every bite . . . a quick, easy way to save time and labor.

(Above right) Bringing the job to the welder is often an impossible task on the construction job. But why worry when a Cletrac will bring the welder to the job as this outfit is doing, so easily.

Cletrac
Crawler Tractors
*Built To Endure*

**The only tractors with controlled differential steering that keeps both tracks pulling at all times . . . on the turn as well as on the straightaway.**

ze... Fifteen Models . . . 22. to 94. Horsepower

# DUST COSTS YOU MONEY!

# USE "VENTUBE" AND SAVE!

"VENTUBE" saves time! Hangs fast! Sections secure in airtight joints in a few seconds. When blasting, "Ventube" slides back quickly and easily from the working face. And when work is completed, "Ventube" rolls up and can be carried to the next job.

Eliminate costly delays by getting rid of dust *faster!* "Ventube" ventilating duct provides adequate fresh air to remote working faces. It forces out the highly explosive dusts caused by drilling and blasting.

"Ventube" is the toughest flexible duct on the market! It's made of extra-heavy, long-fibered Hessian cloth—*both coated and impregnated* with resistant rubber in order to stand up under the terrific force of concussion. It's highly resistant to acid water, rot, fungus, and other destructive forces.

Is dust costing you money? Can your men return to work quickly after blasting? Do your tunnels have adequate fresh air for healthful working conditions? Then try "Ventube." A single trial proves its superiority. Distributors are within quick and easy reach.

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VENTUBE
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**E. I. DU PONT DE NEMOURS & CO., INC.**
**"FABRIKOID" DIVISION**
**FAIRFIELD, CONN.**

# Built for Heavy-Duty Cutting

*of Steel . . Wrought Iron . . Cast Iron*

**PREST-O-WELD* C-105 CUTTING OUTFIT COMPLETE**

(Prices slightly higher west of the Rocky Mountains) **$99.00**

● Let your jobber demonstrate the heavy-duty Prest-O-Weld oxy-acetylene cutting blowpipe which cuts steel up to 12 inches in thickness. See the exclusive "10-second" Prest-O-Weld Detachable Valve Body which permits quick changes from cutting to welding — and the many other advantages of this profitable, efficient and easily portable outfit.

*Trade-Mark

THE LINDE AIR PRODUCTS COMPANY

*Unit of Union Carbide and Carbon Corporation*

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NEW YORK AND PRINCIPAL CITIES

PREST-O-WELD

WELDING AND CUTTING APPARATUS

PRODUCTS OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

# KOEHRING TRAIL-DUMP

High arched rear axle for maximum dumping clearance is an outstanding feature of the Koehring Trail-Dump. Getting away from the load without delay or reduction of travel speed clips seconds from the hauling cycle . . . A low, wide body for quick and easy spotting of dragline bucket, shovel dipper or grader carrier, permits fast and convenient loading, for saving seconds at the loading point.

**Move dirt faster with the Koehring Trail-Dump!**

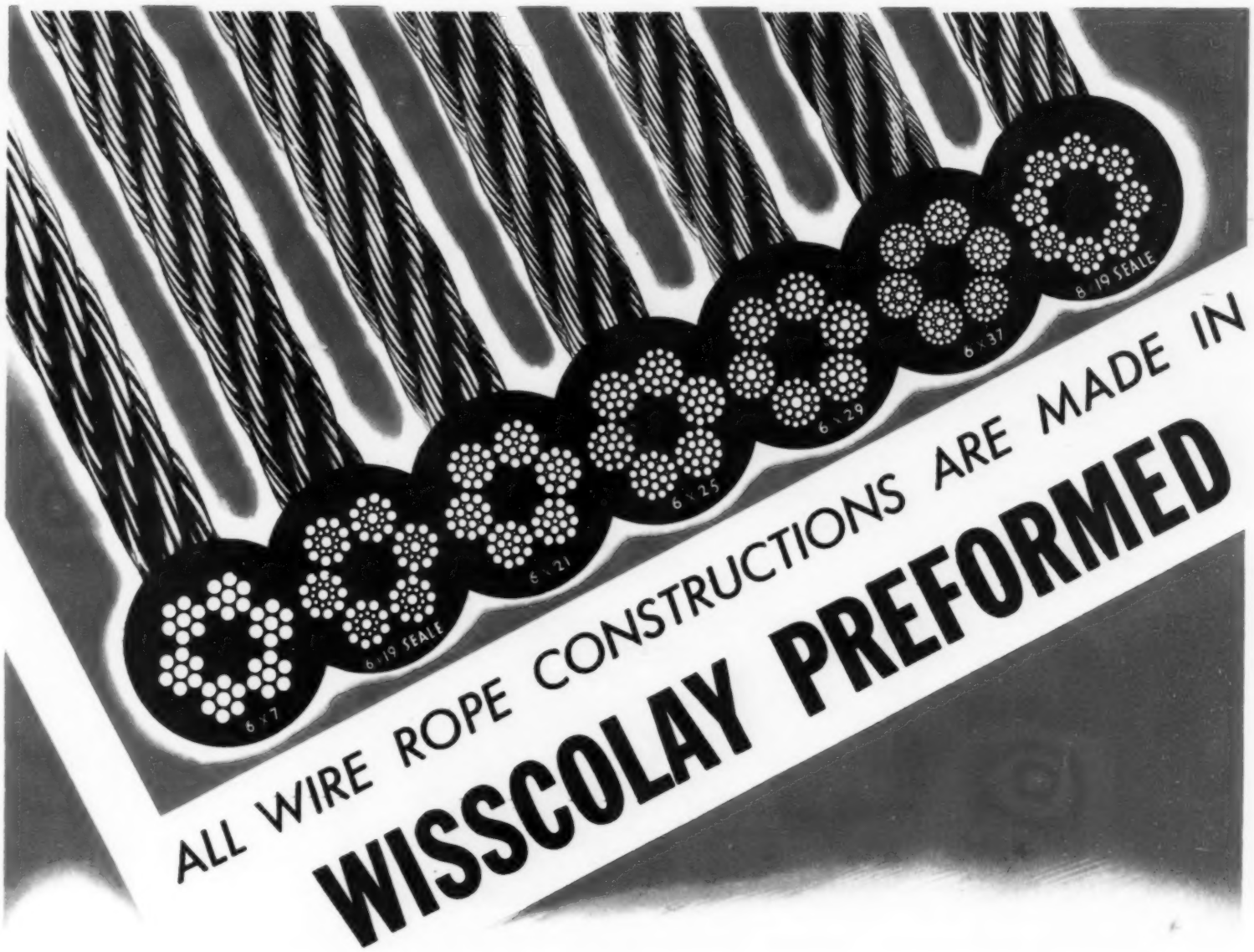
*Attend* 1938 all-star **ROAD SHOW** *At Cleveland*

**EVERYTHING NEW!**

**KOEHRING COMPANY**

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN




## *Select the Rope that Fits Your Job*

In preformed rope as in non-preformed, every wire rope design feature . . . such as number of wires and relative sizes in each strand . . . number of strands . . . length of lay . . . direction of wire twist . . . direction of lay . . . type of center . . . kind of wire . . . each is planned to resist a given type of destruction. Longest rope service is had by properly selecting the type and size of rope for particular use. In order that users of Wickwire Spencer Wire Rope may enjoy the economies of preformed rope to the fullest extent, Wisscolay Preformed is made in every size and type. Let us know your requirements and we will recommend a Wisscolay Preformed Wire Rope that will give you the longest possible life.

• •

WICKWIRE SPENCER STEEL COMPANY, *General Offices:* 41 East 42nd Street, New York. *Sales Offices and Warehouses:* Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles; *Export Sales Dept.:* New York.

WICKWIRE SPENCER SALES CORPORATION, New York, Chattanooga, Tulsa, Portland, Seattle.

**WIRE ROPE**
**by Wickwire Spencer**

Wickwire Spencer also manufactures all sizes and types of Wire Rope in Wisscolay.

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Please send me my free copy of your popular, new money saving manual, "Know Your Ropes".

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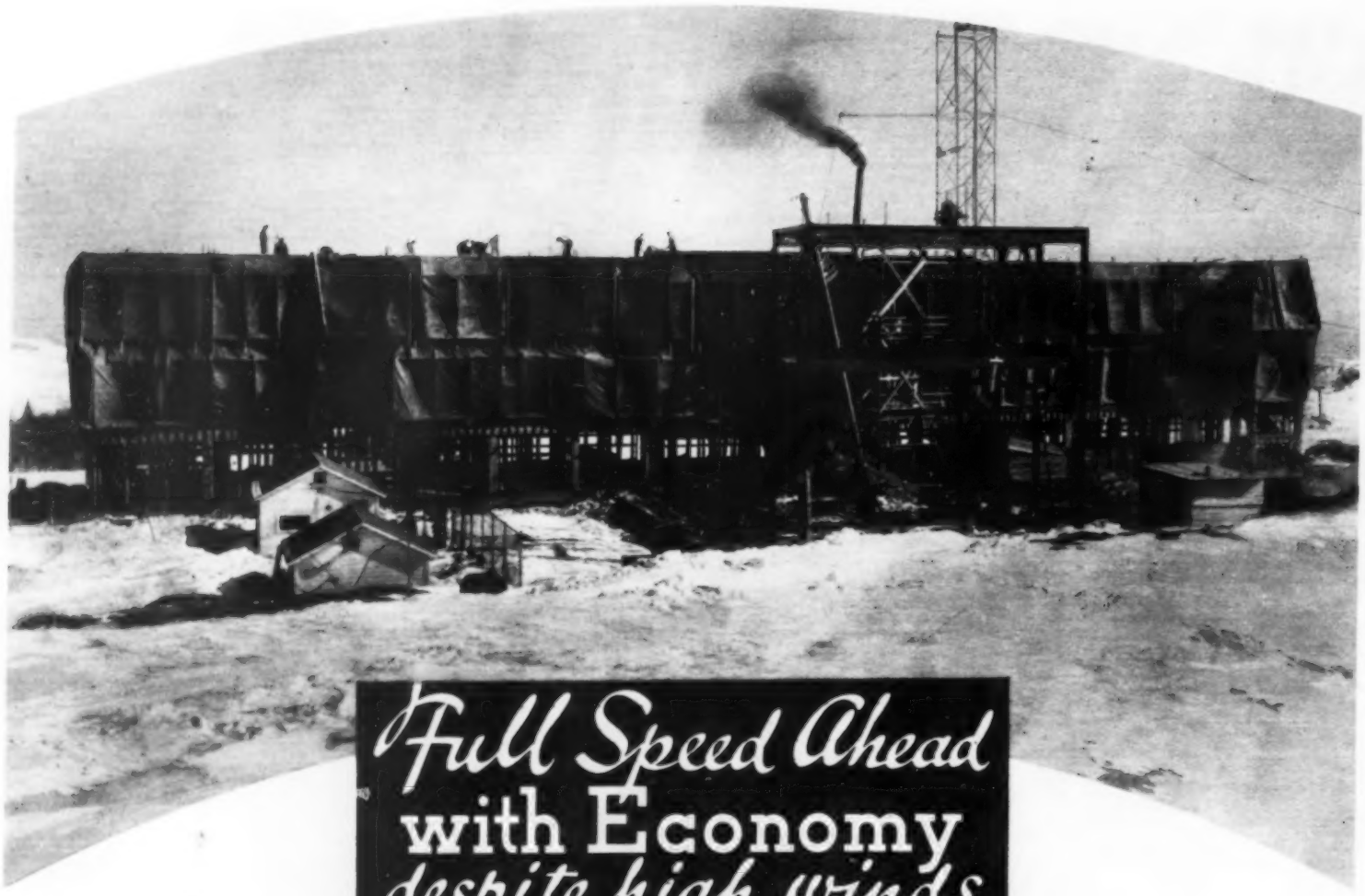


# Full Speed Ahead with Economy despite high winds and Zero weather

High on a bluff overlooking Lake Superior rises the Villa Sancta Scholastica. During construction—through the winter of 1936-37—high winds and sub-zero temperature presented a problem. Heat curing as a protection against freezing was difficult. The fire hazard was great. Faced with these difficulties, and possible delay in construction, the contractor as a safeguard used Lehigh Early Strength Cement.

Results: the construction schedule was carried on without interruption throughout the winter—heat protection costs were reduced two-thirds—form requirements reduced from three sets to two sets—construction time on the tower brickwork reduced by eight days. On form erection costs alone the savings were $300.

Compared with normal portland cement Lehigh Early Strength Cement makes better, denser concrete in one-third to one-fifth of the time. Use it to save time by minimum concrete curing period; for insurance against freezing hazards; to save on costs, and to speed up the construction schedule. Contractors are invited to consult the Lehigh Service Department on the use of Lehigh Early Strength Cement for any specific project.

LEHIGH PORTLAND CEMENT COMPANY, Allentown, Pa., Chicago, Ill., Spokane, Wash.

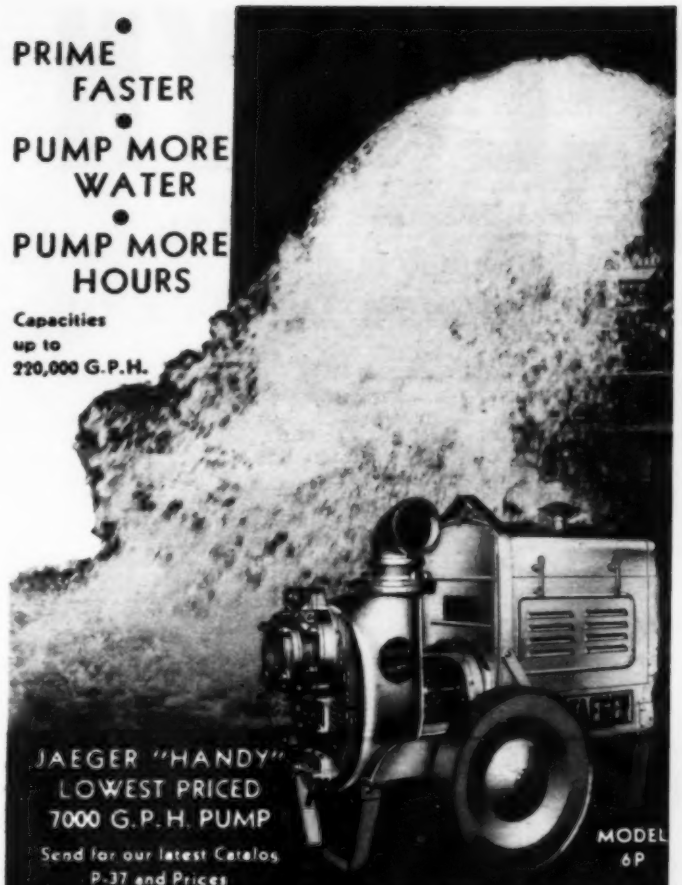
**Villa Sancta Scholastica, Kenwood, Duluth, Minn.**

Owners: Sisters of St. Benedict
Architect: O'Meara & Hills, G. E. Quick, Associate } St. Louis, Detroit, Minneapolis
Contractor: McGough Bros., St. Paul, Minn.

## LEHIGH EARLY STRENGTH CEMENT

PRIME
FASTER
PUMP MORE
WATER
PUMP MORE
HOURS

Capacities
up to
220,000 G.P.H.



JAEGER "HANDY"
LOWEST PRICED
7000 G.P.H. PUMP

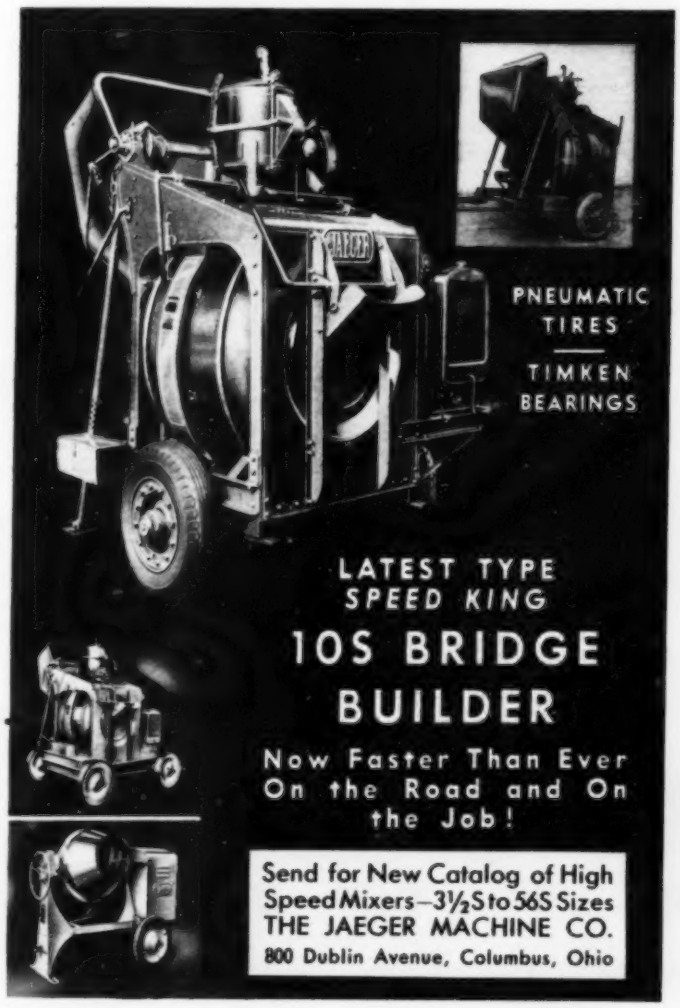
Send for our latest Catalog
P-37 and Prices

MODEL
6P

**JAEGER "SURE PRIME" PUMPS**

THE JAEGER MACHINE CO.
800 Dublin Avenue Columbus, Ohio





PNEUMATIC
TIRES

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BEARINGS

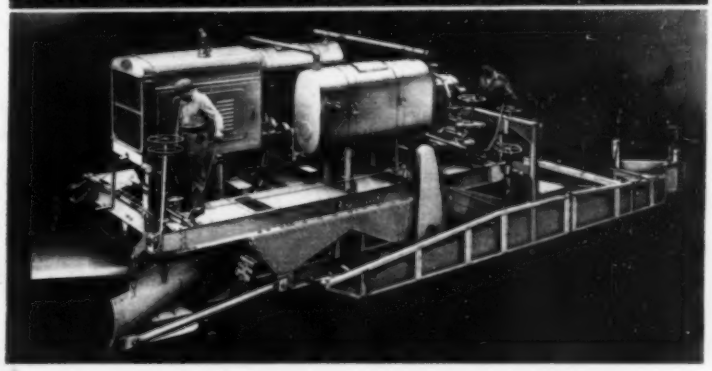
LATEST TYPE
*SPEED KING*
**10S BRIDGE
BUILDER**

Now Faster Than Ever
On the Road and On
the Job!

Send for New Catalog of High
Speed Mixers—3½S to 56S Sizes
THE JAEGER MACHINE CO.
800 Dublin Avenue, Columbus, Ohio



**The MODERN METHOD
for LOW COST ROADS**



**JAEGER Mix-in-Place
ROAD BUILDER**

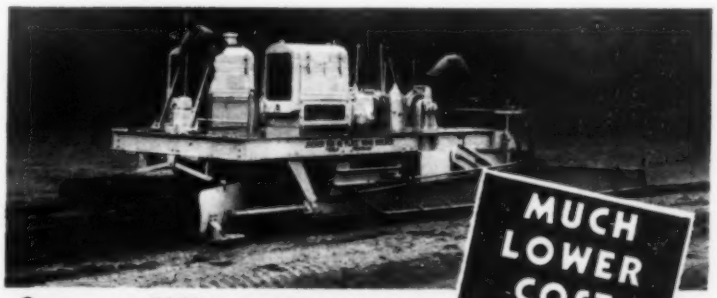
Self-Propelled Mixing, Spreading
and Finishing Machine for
Heavy Retread and Stabilized Base

A BETTER MIX

Picks up materials and passes them thru twin pugmill—gives plant mix results with a one-pass road-mix!

A SMOOTHER SURFACE

21 ft. straight-edge levelers equalize rough subgrade, spreading screw and screed lay a finished surface, ready for rolling—MIXED AND LAID IN ONE PASS!



MUCH LOWER COST

Saves up to 50% investment in tractors, blades, etc., plus much lower job costs with one machine laying up to 70 cu. ft. a minute IN ONE PASS!

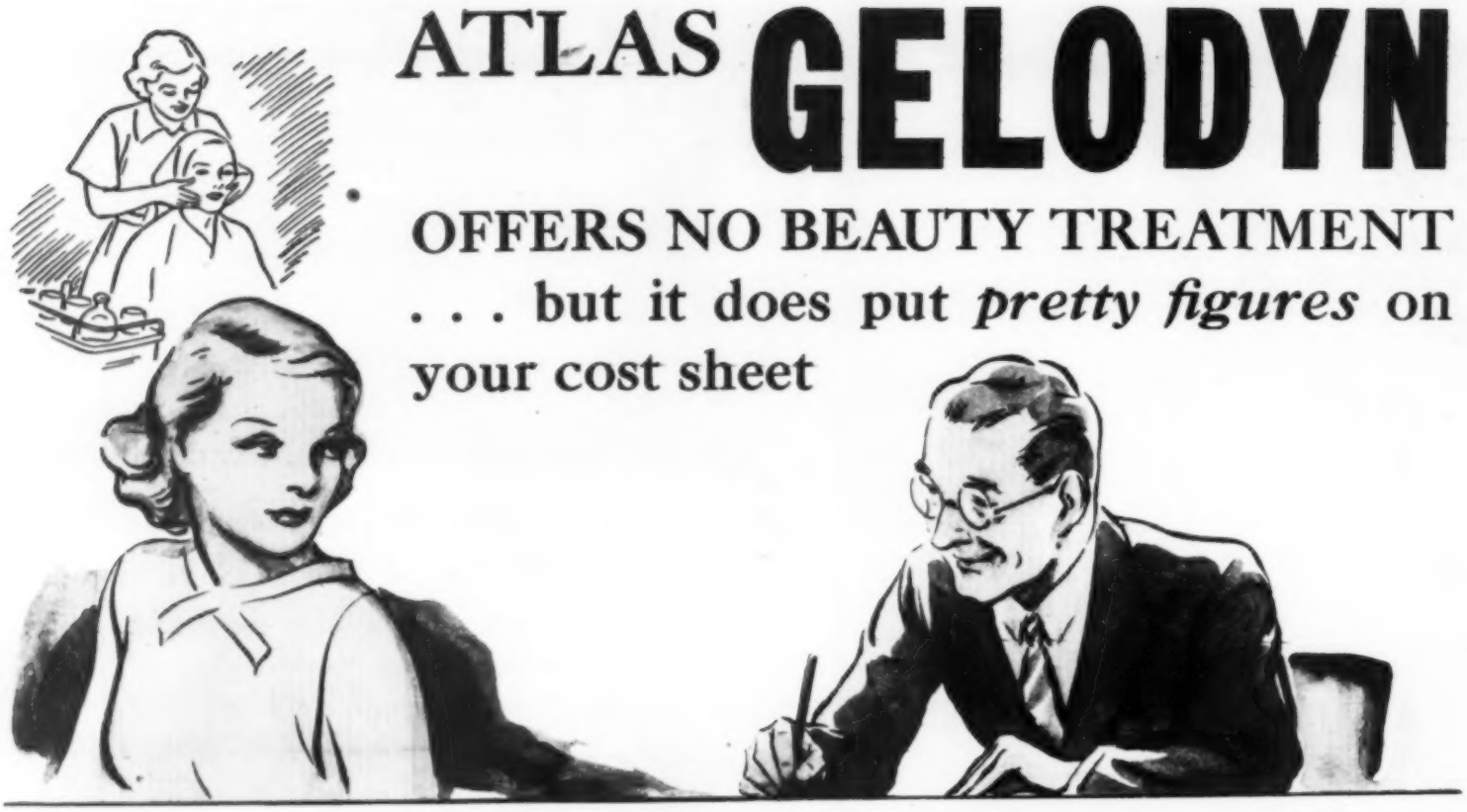
Also Built in Popular Priced Tractor-Drawn Model for Light Retread and Stabilization--For Full Details Send for Catalog MP-37.

**THE JAEGER MACHINE CO.**
800 DUBLIN AVE. COLUMBUS, OHIO

# ATLAS GELODYN

## OFFERS NO BEAUTY TREATMENT

## . . . but it does put *pretty figures* on your cost sheet

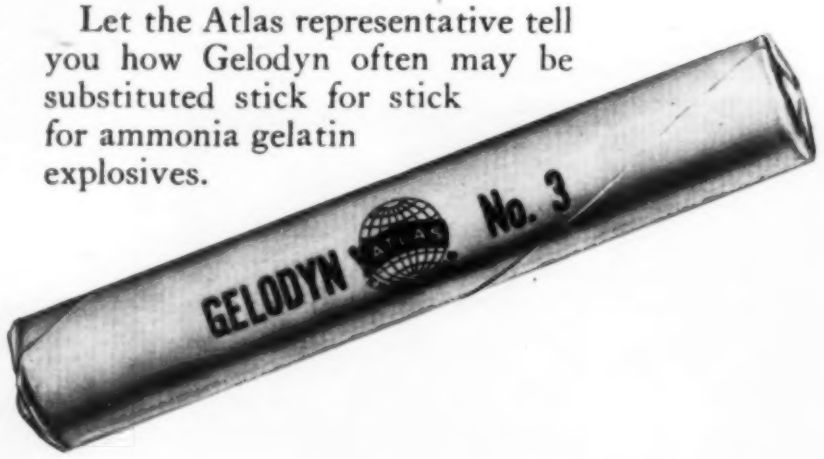


ATLAS Gelodyns provide a combination of qualities which on many jobs give "reducing exercises" for cost record figures.

Consider the savings from higher cartridge count! Atlas Gelodyn No. 3 averages 120 cartridges per 50-pound case as against the average 95 cartridge count of a case of standard 40 and 50 per cent ammonia gelatin explosives.

Bear in mind that Gelodyns offer better water resistance than non-gelatinous explosives. Remember that Gelodyn fumes are satisfactory for most underground work—that Gelodyns are plastic for ready retention in upward pitching boreholes!

Let the Atlas representative tell you how Gelodyn often may be substituted stick for stick for ammonia gelatin explosives.




## ATLAS POWDER COMPANY, WILMINGTON, DEL.

**Cable Address—Atpowco**

*Everything for Blasting*

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| Allentown, Pa. | Joplin, Mo. | New Orleans, La. | Pittsburgh, Pa. | Spokane, Wash. |
| Boston, Mass. | Kansas City, Mo. | New York, N. Y. | Portland, Oregon | St. Louis, Mo. |
| Butte, Mont. | Knoxville, Tenn. | Philadelphia, Pa. | Salt Lake City, Utah | Tamaqua, Pa. |
| Denver, Colo. | Los Angeles, Calif. | Picher, Okla. | San Francisco, Calif. | Wilkes-Barre, Pa. |
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# ATLAS

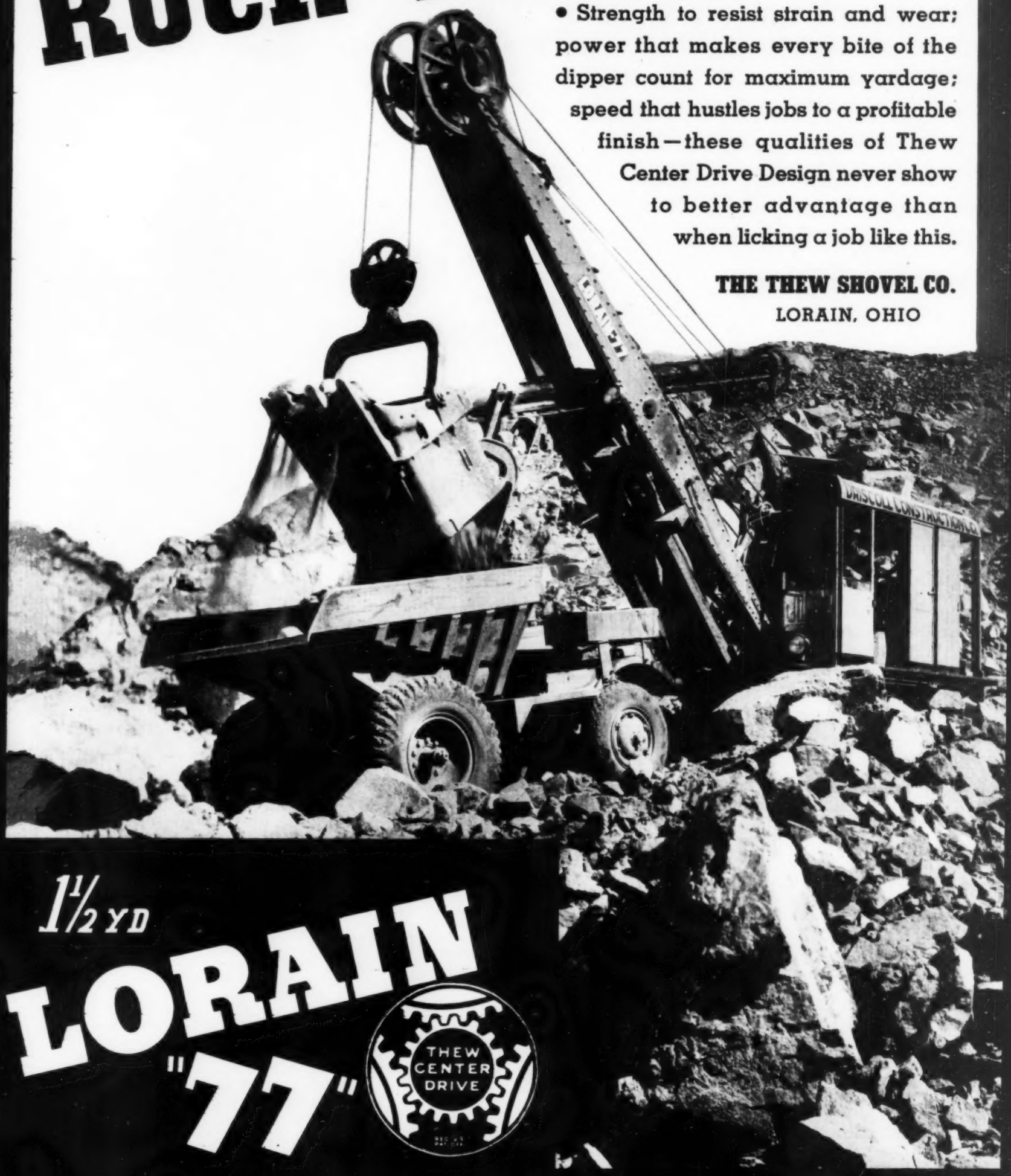
## EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

# Rock-Worthy

• Strength to resist strain and wear; power that makes every bite of the dipper count for maximum yardage; speed that hustles jobs to a profitable finish—these qualities of Thew Center Drive Design never show to better advantage than when licking a job like this.

**THE THEW SHOVEL CO.**
LORAIN, OHIO




1½ YD

# LORAIN "77"

THEW CENTER DRIVE

# FLEET

THE FLEET'S OUT — THE OWNER'S IN! — A fleet of five "Caterpillar" Diesel RD7 Tractors building an approach to the Independence-Liberty Bridge near Liberty, Mo. These Diesels pull LeTourneau Carryall Scrapers, use about 4 gallons of 7c fuel per hour per machine.

MUDDER — Here's a Diesel RD8 Tractor with a LeTourneau Bulldozer working on the Chickamauga Dam, at Chattanooga, Tenn. It takes a "Caterpillar" Diesel Tractor to work under any and all conditions — profitably.

# MANEUVER

When a firm buys one "Caterpillar" Diesel Tractor, it may be an experiment, based upon good reports. But, when it buys four more, you know that experience has replaced experiment; that the first one has paid out. Here it is November, with Old Man Winter puffing up his bellows. You'll be glad to know that "Caterpillar" Diesel Tractors start quick in cold weather, stay on the job. They have both action and traction when it's bad underfoot. On construction-jobs, many of these tractors have seen 10,000, 12,000 and even 15,000 and more hours of service, and are *still* too good to trade-in. Ask any fleet-owner!

## CATERPILLAR TRACTOR CO.

## PEORIA, ILL.

LARGEST MANUFACTURER OF DIESEL ENGINES,
TRACK-TYPE TRACTORS AND ROAD MACHINERY

# Save with LAPLANT-CHOATE BULLDOZERS

Antiquated and inefficient equipment is bound to increase your operating costs. You can cut these unnecessarily high costs by modernizing with dependable, easy-to-operate LaPlant-Choate Bulldozers. They embody every essential up-to-the minute feature for efficient, reliable work. One man has absolute control of the unit at all times. This is made possible by Positive Hydraulic Control. You have down pressure instantly to make the blade dig. And the blade can be locked in any position to keep it from hopping over rocks and stumps. Proper balance and sturdy construction reduce lost time and upkeep costs. And when the Bulldozer is not in use, it can be easily detached and the "Caterpillar" track-type tractor is freed for other work. These are but a few of the many outstanding modern features of LaPlant-Choate Bulldozers.

LaPlant-Choate Bulldozers are designed exclusively for use with "Caterpillar" track-type tractors. This assures you of competent and readily available service facilities from any of the hundreds of "Caterpillar" dealers throughout the country. Get complete details today from your nearest "Caterpillar" dealer or write direct to the manufacturer.

RUBBER WHEELED WAGONS
BRUSH CUTTERS
SNOW PLOWS

ROADBUILDERS
SCRAPERS
TAMPING ROLLERS

## LA PLANT-CHOATE MANUFACTURING CO. Inc.

CEDAR RAPIDS, IOWA.

# YES IT'S PROVED!

**READ WHAT THEY SAY ABOUT THIS PATENTED DISCOVERY—**
**"RPM" DIESEL ENGINE LUBRICATING OIL**

**MARYLAND**
"We can say nothing but the best for 'RPM' Diesel Engine Lubricating Oil."

**NEVADA**
"The most satisfactory oil obtainable for performance and economy. We operated 10,000 hours and didn't lose a minute nor spend one penny on upkeep. . . . Conditions extremely dusty."

**ARKANSAS**
"We know from experience this oil returns considerable savings in servicing costs as well as longer engine life"

**IDAHO**
"Am operating 60 hours between drains and the oil is as good as when first put in—also oil pressure is the same at all times."

"Fourteen months ago I began using 'RPM' Diesel Engine Lubricating oil... most of my problems were eliminated... Have just completed a six mile project involving 1,000,000 cu. yds. of dirt... Used eight RD-8 and 75 'Caterpillar' Diesel Tractors and am convinced that your product has increased their life and reduced service costs"

(Signed) D. B. HILL
General Contractor
Little Rock, Ark.

**ALASKA**
"The finest oil that I have ever used in a 'Caterpillar' Engine."

**NEW BRUNSWICK**
"Experience so satisfactory we now purchase 'RPM' Diesel Engine Lubricating Oil in carload lots."

**CALIFORNIA**
"Been running night and day for 2,464 hours on 'RPM' Diesel Engine Lubricating Oil—performing 100%."

**IDAHO**
"This oil has proved everything claimed for it."

**NORTH CAROLINA**
"Never have to add oil between changes. This never happened before 'RPM' Diesel Engine Lubricating Oil was used."

LOOK FOR THIS TRADE MARK

**RPM**
REG. U.S. PAT. OFF.
**DIESEL ENGINE LUBRICATING OIL**

*Recommended by*
CATERPILLAR TRACTOR CO.

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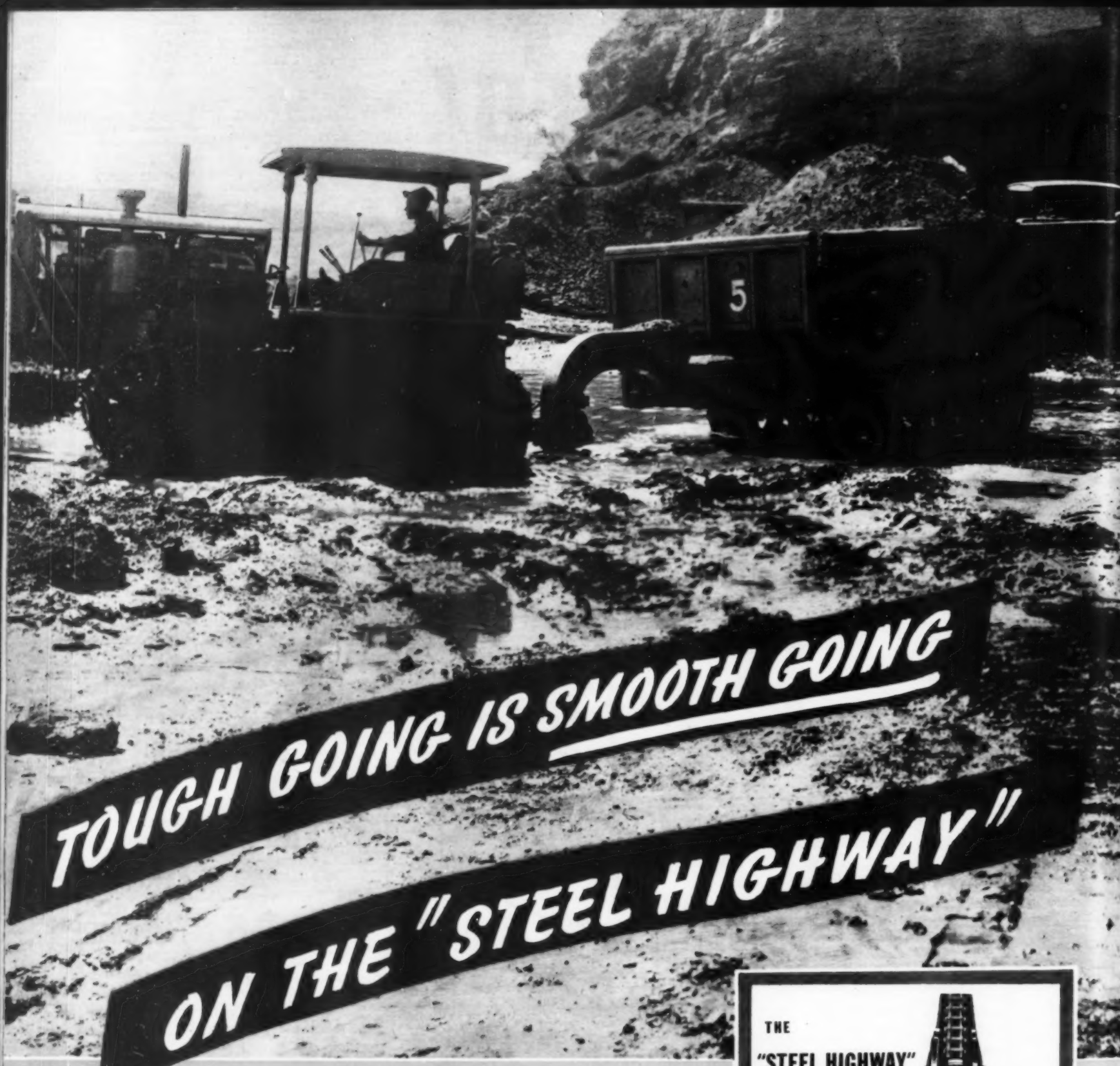



# TOUGH GOING IS SMOOTH GOING ON THE "STEEL HIGHWAY"

The surest, easiest, *most profitable* way to keep your big loads moving is to use the Athey Forged-Trak "Steel Highway." Then you'll be free of hauling delays and interruptions. Then you'll be *sure* of making schedules regardless of muck, sand, rough ground or steep grades.

Athey Forged-Trak 2-Way Dump Trailers, used with "Caterpillar" Diesel Tractors carry bigger loads in their "double-husky" bodies. Dumping to left or right is always swift and clean. Maneuvering in tight quarters is easy. Road preparation and maintenance are negligible with Athey 2-Way Dump Trailers—their broad tracks improve instead of destroy your roadway. See your Caterpillar dealer about this better, more economical way of hauling—or write us direct.

**ATHEY**
**Forged-Trak**

Athey Truss Wheel Co.
5631 West 65th St.,
Chicago, Illinois
Cable Address: "Trusswheel"
Chicago

**TWO-WAY DUMP TRAILERS**

# IN THE ALTAMONT

ACTUAL JOB DATA

**1700 FEET ROUND TRIP—**
**117 CU. YDS. HOURLY**

**When Granfield, Farrar & Carlin, long-time LeTourneau fleet users, took the contract for realigning U. S. Highway 50 through Altamont Pass in California, they put 17 LeTourneau Carryall Scrapers on the job of handling the 1,875,000 cubic yards of excavation and the 26,000,000 station yards of overhaul. Six of these are U-20's. In rocky material that was broken by a LeTourneau Rooter, these U-20's assisted by a pusher "Caterpillar" Diesel, picked up heaping loads in an average of .97 minutes, made 7.8 trips per Scraper hour on a 1700-foot round trip haul, delivered 15 pay yards per trip — 117 cubic yards hourly!**

**U-20 Carryalls and tandem hook-ups of smaller Carryalls are particularly economical on long hauls. If you have long hauls on your job, ask the LeTourneau Field Engineering Department what LeTourneau Carryalls can do for you.**

**A part of Granfield, Farrar & Carlin's LeTourneau U-20 fleet travelling loaded through the big cuts on the Altamont Pass realignment job. The pusher tractor increases the load and cuts loading time.**

***Job observed and data certified by our Field Engineering Dept. You are invited to call on this Dept. for aid in estimating and planning the best methods of handling your earthmoving problems.*

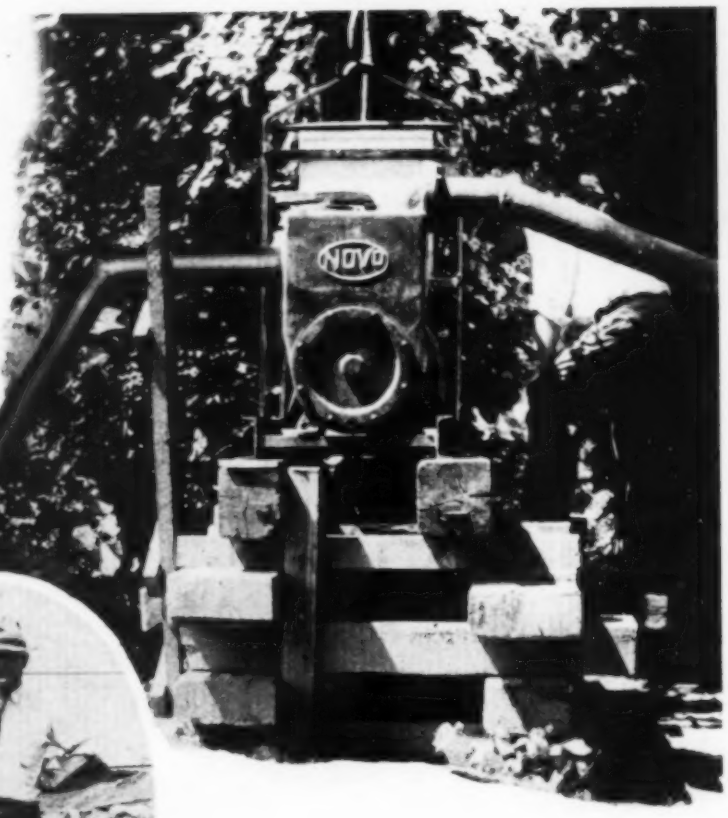
# LETOURNEAU

R. G. LeTOURNEAU, INC. • Peoria, Illinois • Stockton, California • Cable Address: "BOBLETORNO"

Manufacturers of . . . ANGLEDOZERS*, BULLDOZERS, CRANES, CARRYALL* SCRAPERS, BUGGIES*, DRAG SCRAPERS, ROOTERS*, POWER CONTROL UNITS, TREEDOZERS

*Name Registered U. S. Patent Office.

# This Month's NOVO NEWS REEL



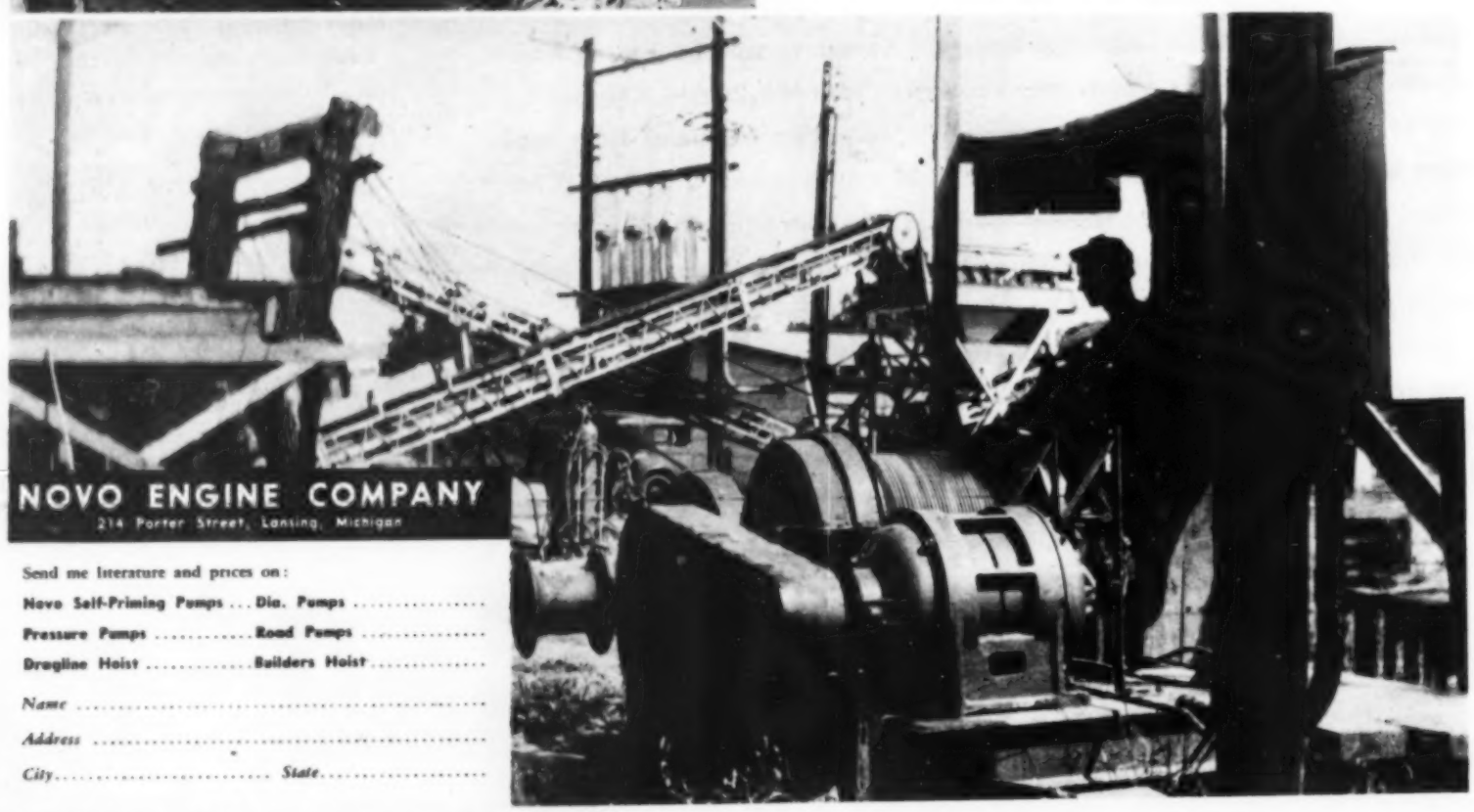

Lashed to a tree and blocked high in the air to prevent the flood waters from washing it away is this Novo 4" Self-Priming Centrifugal Pump, powered with a 25 H.P. Motor. Installed to furnish water for the washing plant of the Licking Gravel Company of Newark, Ohio. The suction lift is, by necessity, over 15'. The water is carried 565' to the plant then up 35' through a 90° elbow to the top of the plant. Ample water and pressure are furnished to wash 400 Cu. Yds. of high grade gravel per day.

Mr. Earl Watkins, Supt., steps forward to say that that is a real pumping job and it's being performed in an O.K. manner.

This 40 H.P. electric motor powered Novo Dragline Hoist is another reason for Mr. Watkins doing a little "pointing with pride at the record." He is taking out 400 Cu. Yds. a day using a 400' span with a 1 yard bucket.

Hoist is multiple steel roller chain drive. The double cone friction blocks are of asbestos composition, giving a double friction area of highly efficient, long-lived material.

You can send in the coupon for complete information on Novo Self-Priming, Centrifugal, Diaphragm, Pressure, and Road Pumps. Also any type and size of Builders and Dragline Hoists.



**NOVO ENGINE COMPANY**
214 Porter Street, Lansing, Michigan

Send me literature and prices on:

Novo Self-Priming Pumps ... Dia. Pumps .....

Pressure Pumps ..... Road Pumps .....

Dragline Hoist ..... Builders Hoist .....

*Name* .....

*Address* .....

*City* ..... *State* .....

# Teamwork

*If a Preformed Wire Rope is the most suitable for your equipment, you can depend on Preformed "HERCULES" (Red-Strand) Wire Rope for maximum efficiency. Available in both Round Strand and Flattened Strand constructions. It pays to use the best.*

The crack basketball team works as a well-balanced unit. Dribbles and lightning passes from player to player form the "set-up" for shooting the basket . . . impossible, unless each man does his part.

Good Wire Rope, too, must work as a well-balanced unit. Those essential characteristics of strength, elasticity, durability, flexibility and toughness must be perfectly coordinated—each helping the other—to make an enduring, economical wire rope. And none of these five essentials should be more important than the others!

This balanced construction is the reason "HERCULES" (Red-Strand) Wire Rope is so efficient—so economical—and so long lasting. It's wire rope that offers you the advantages of "teamwork" over the weakness of "grandstand" play.

WIRE ROPE MAKERS **A. Leschen & Sons Rope Co.** ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

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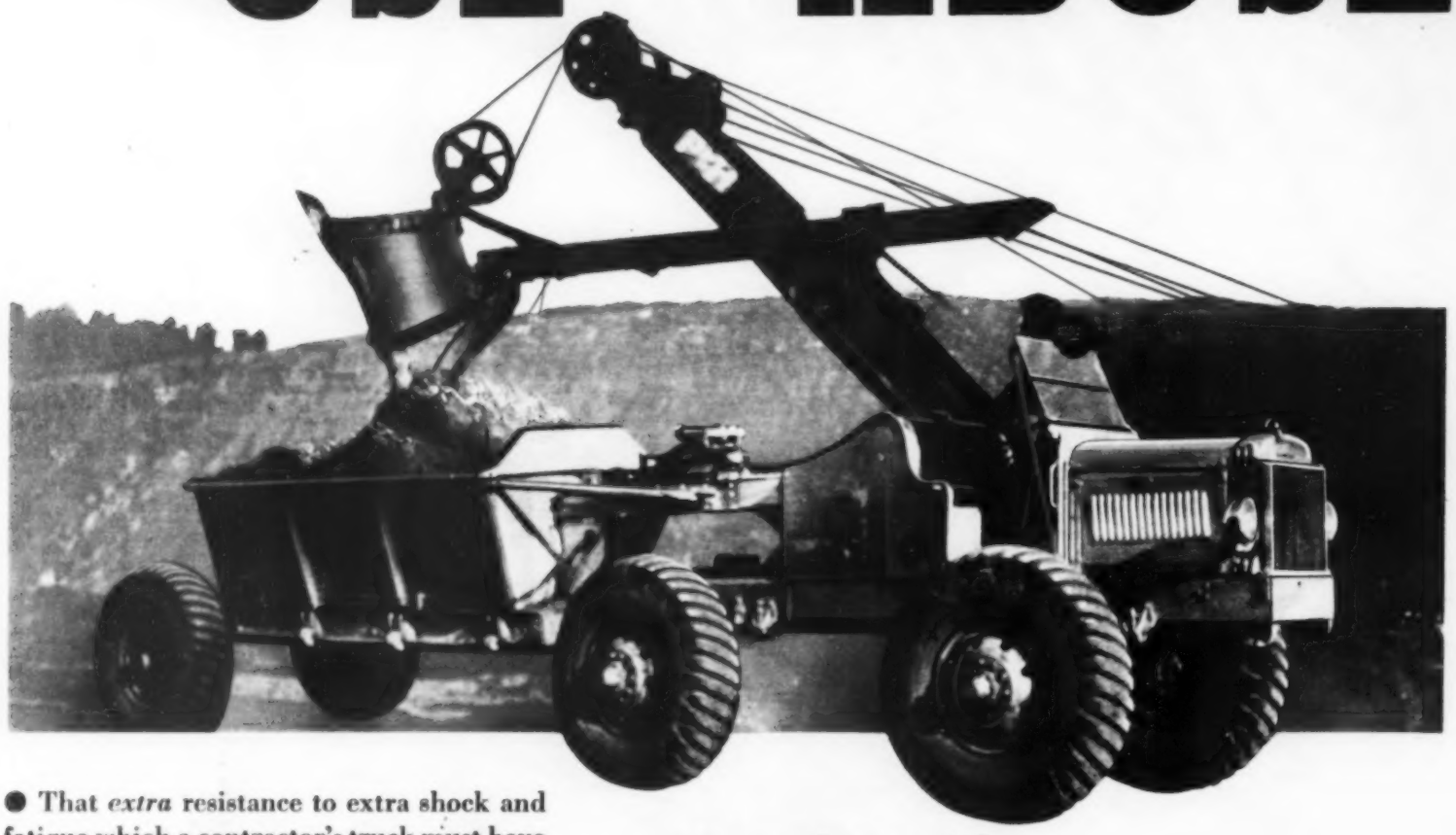
| New York | 90 West Street | San Francisco | 520 Fourth Street |
| Chicago | 810 W. Washington Blvd. | Portland | 914 N. W. 14th Avenue |
| Denver | 1554 Wazee Street | Seattle | 2244 First Avenue South |

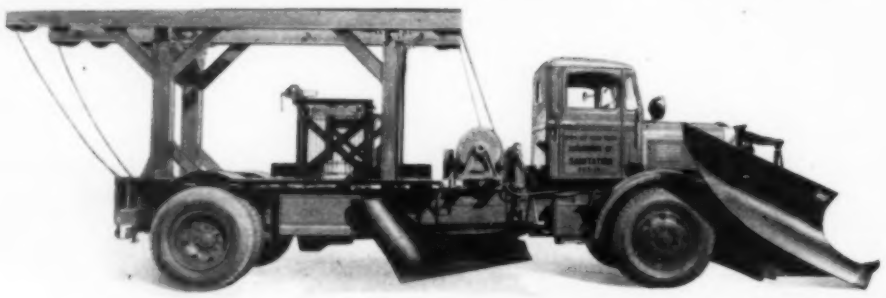
# *Where* USE *means* ABUSE



● That *extra* resistance to extra shock and fatigue which a contractor's truck must have ...is provided in the four wheel drive "Earth Mover" by various steels alloyed with Nickel. Axle shafts both front and rear, steering arms, transmission gears, and spline shafts use 4 different compositions of steel. But each is alloyed with Nickel and treated to stand the particular stress and wear which falls on each job. This unit crawls like a tractor through soft earth, yet it does around 40 miles an hour on the highway. Made by Oshkosh Motor Truck Inc., Oshkosh, Wis.

## ...*strengthen with*

## NICKEL ALLOY STEELS

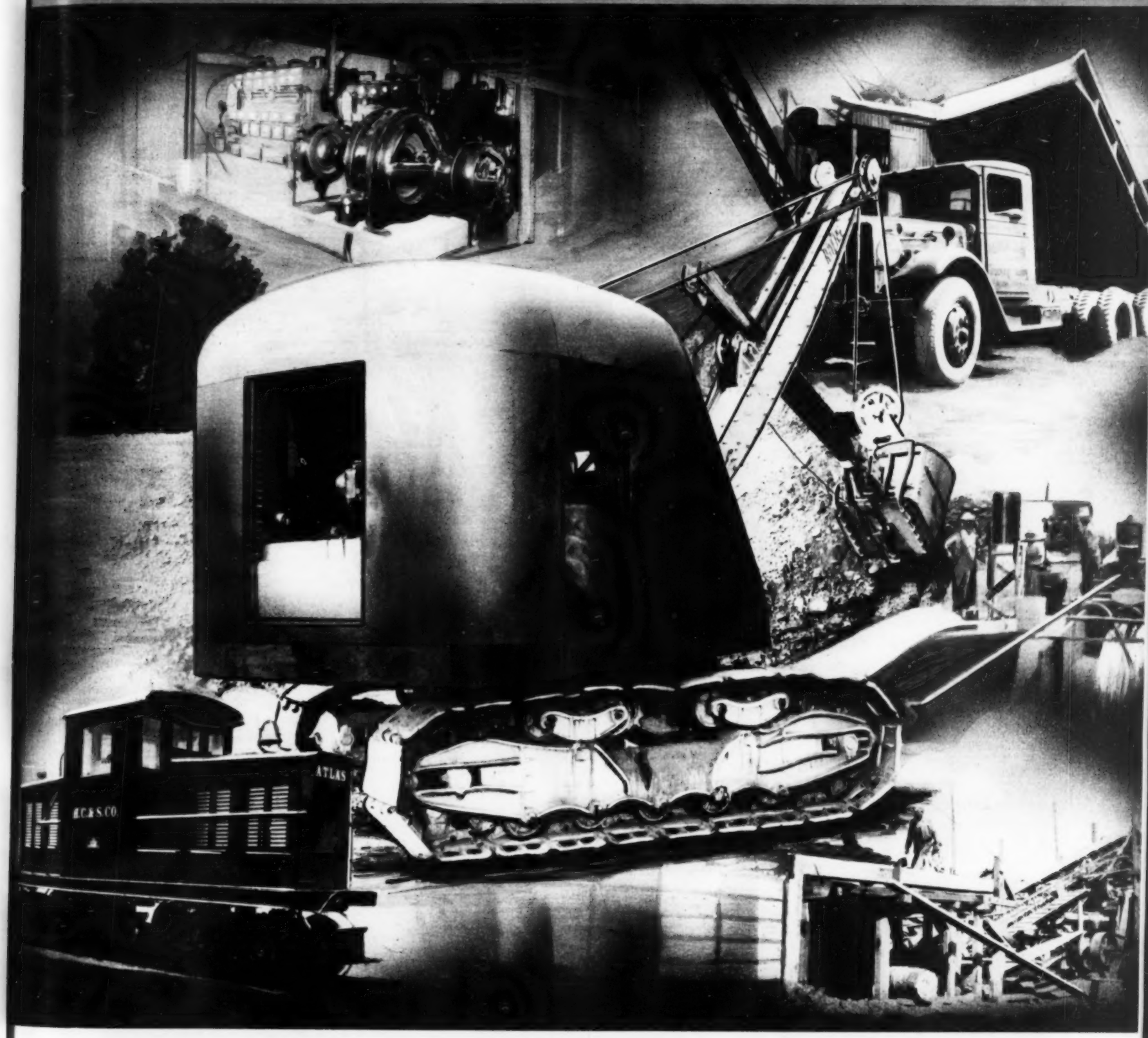


● The wrecker truck, like this one of twenty on a regular beat in New York City, does a giant's job every day. Its makers, Four Wheel Drive Auto Co., Clintonville, Wis., built it to stand overloading as regular routine. Wherever shock and fatigue strike hardest, this firm uses Nickel Steels: In axle differential gears and drive shafts, Nickel-molybdenum steels corresponding to SAE 4615 and 4340. In other highly stressed parts, other Nickel and Nickel-chromium steels assure the needed reserve of strength.

● The Waukesha-Hesselman Diesel powered "Lima" power shovel grabs giant bites of earth, tosses them, drops them...and resists the uneven shocks it takes. Steels containing Nickel are standard for vital parts of equipment subjected to such gruelling service. Consultation on the selection or treatment of suitable Nickel Alloy Steels for your particular application is invited.

**THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.**

# POWERED BY CUMMINS DIESELS




Contractors demand an engine that is Quick Starting, Speedy, Powerful and Economical, backed by good service. That's why many of the nation's largest buy Cummins Diesel-powered equipment. A complete line . . . 20 to 500 hp.

**CUMMINS ENGINE COMPANY, 1701 WILSON STREET, COLUMBUS, INDIANA**

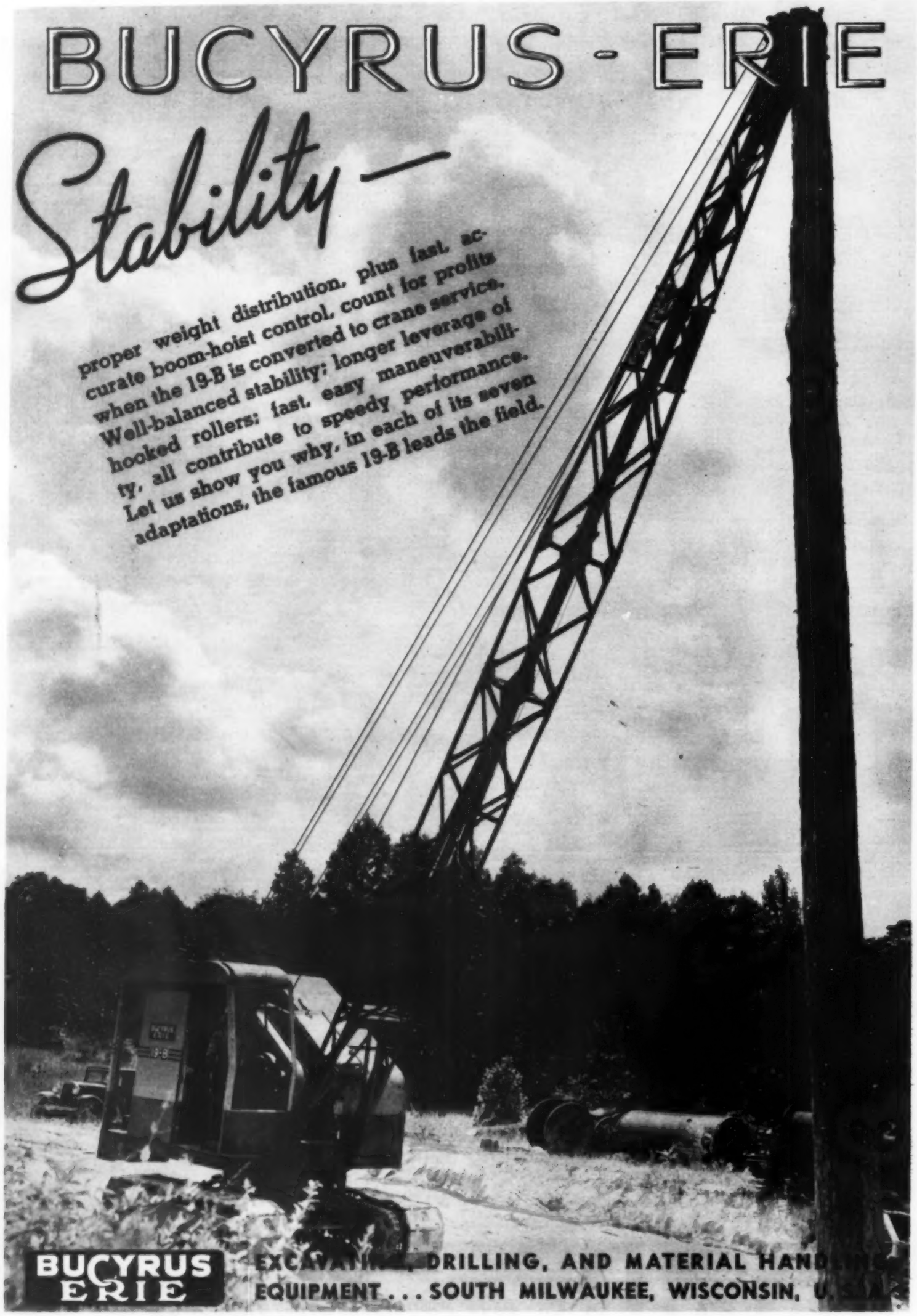
## CUMMINS *Dependable* DIESEL

PIONEER IN MODERN DIESEL DEVELOPMENT

# BUCYRUS-ERIE

## *Stability*—

proper weight distribution, plus fast, accurate boom-hoist control, count for profits when the 19-B is converted to crane service. Well-balanced stability; longer leverage of hooked rollers; fast, easy maneuverability, all contribute to speedy performance. Let us show you why, in each of its seven adaptations, the famous 19-B leads the field.



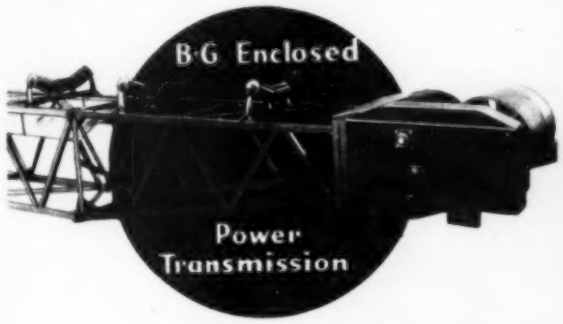
BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT . . . SOUTH MILWAUKEE, WISCONSIN, U.S.A.

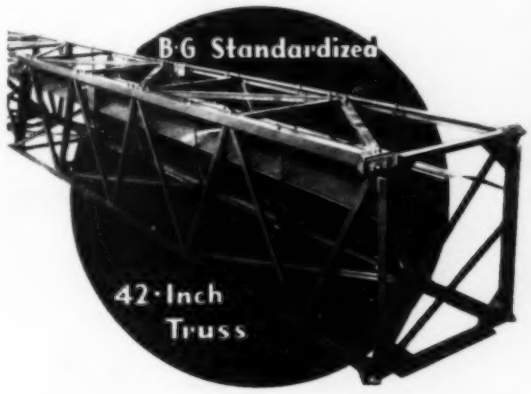
# Via Barber-Greenes

Here are two new Barber-Greenes doing a perfect job in an ideal plant.

The conveyor on the right is 160′ long, with a Barber-Greene steel truss 42″ deep. This conveyor not only has fairly long spans, but carries an 8″ water pipe in addition to the walkway.




The left conveyor, which runs horizontally just above the ground, is mounted on wood stringers as no long spans are necessary.




Both conveyors are driven by the new Barber-Greene enclosed transmission, an all welded steel unit, dust tight, internally lubricated. This transmission is available in two sizes, has highest quality anti-friction bearings and precision made steel gears and sprockets.

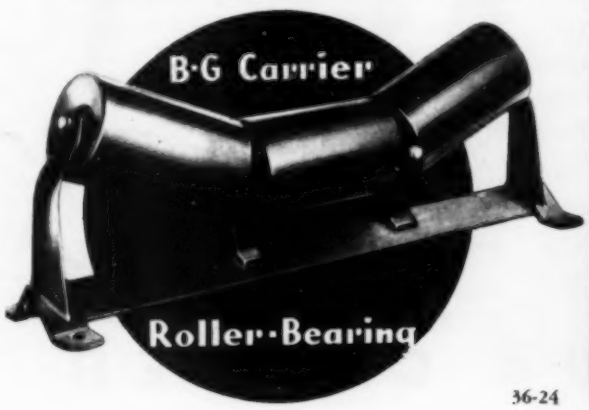
The new Barber-Greene 42″ deep welded steel truss has all the well known B-G advantages, standardized sectional construction, quick easy erection, etc.

The carriers on both conveyors are the finest made by Barber-Greene: unbreakable, all welded steel base, end brackets die formed, oversize Shafer Self Aligning Roller Bearings. FOUR pass labyrinth grease seals keep the grease in and grit out.

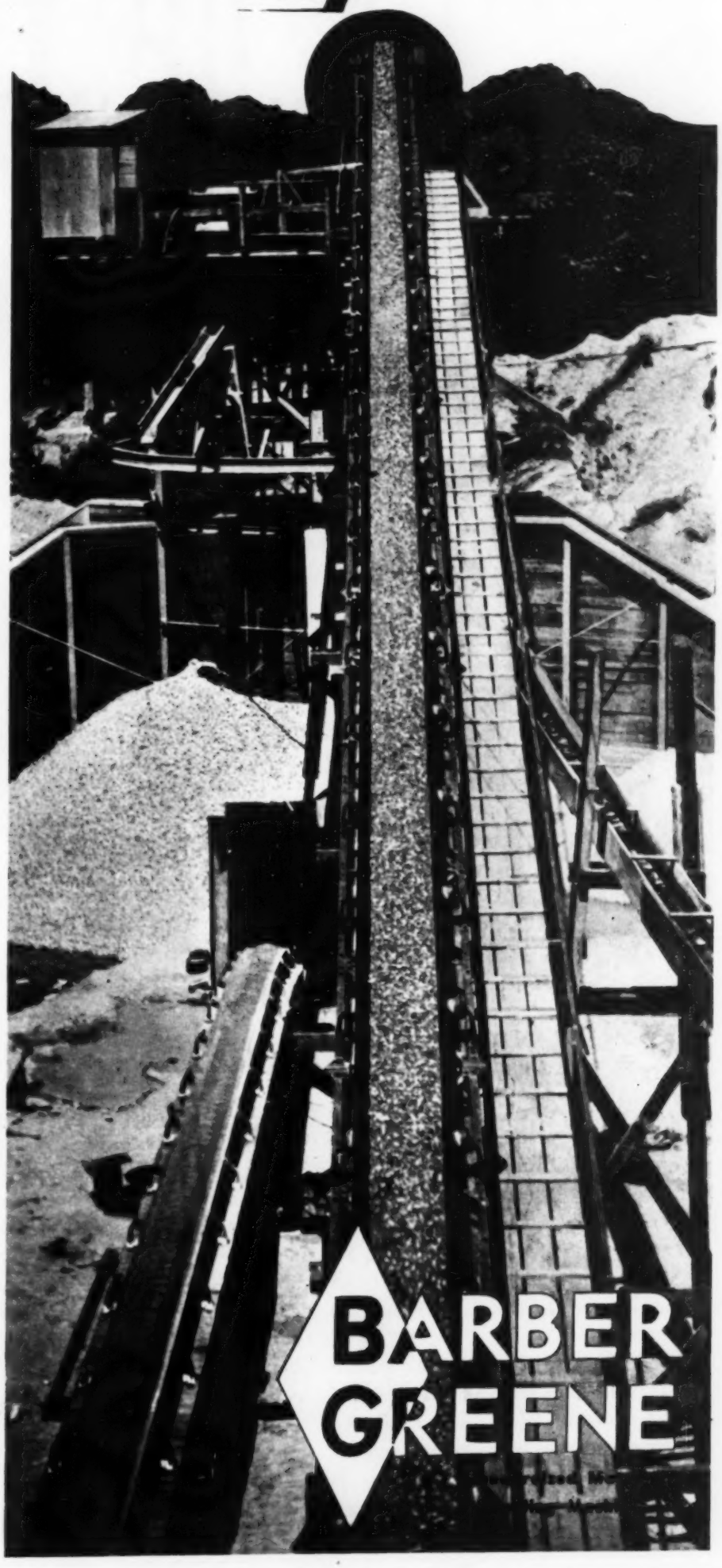
The carriers alone justify your inquiry. Send a card or letter today for full information on Barber-Greene Conveyors. Remember we maintain a department for the sole purpose of solving your material handling problems the most efficient, economical way. There is no obligation.

**BARBER-GREENE COMPANY**

**530 West Park Avenue, Aurora, Illinois**

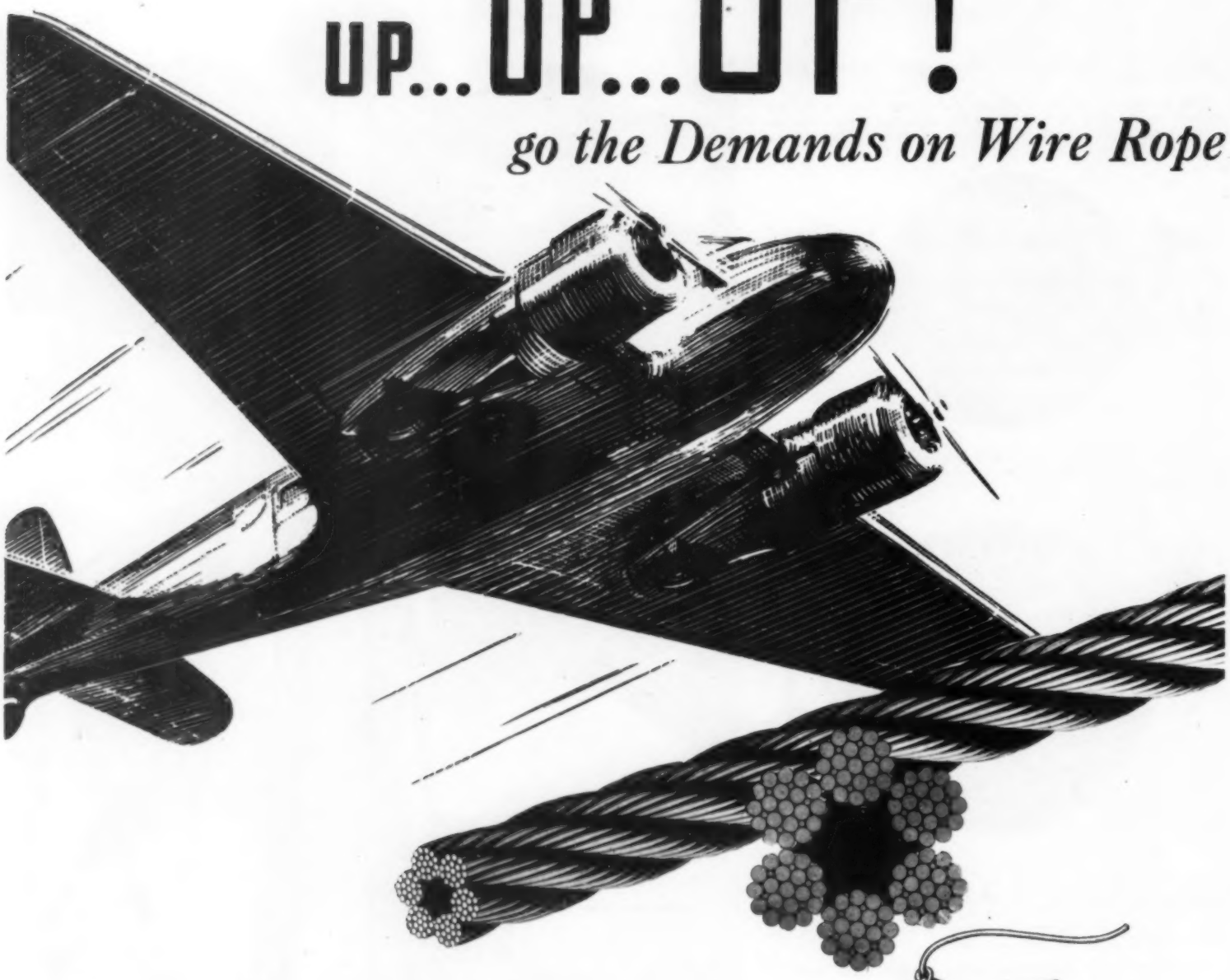



36-24



# UP... UP... UP!

*go the Demands on Wire Rope*



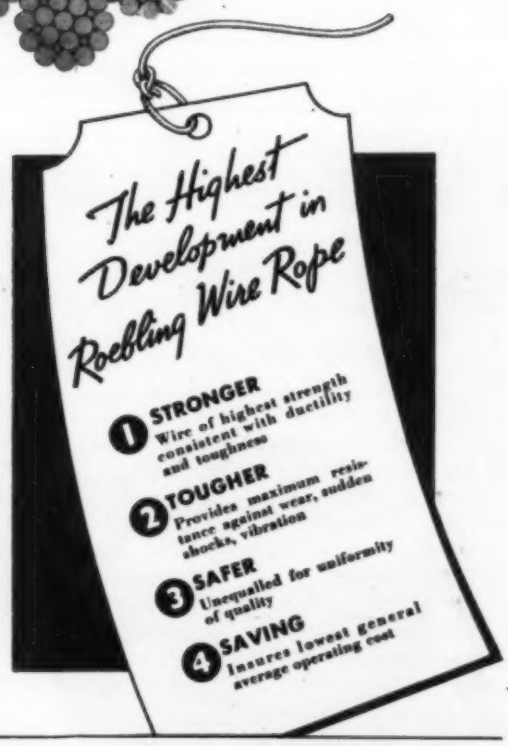
## *Severest Requirements met by ROEBLING "BLUE CENTER"*

To REDUCE operating costs to a minimum, it has been necessary in many instances to increase the capacity of wire rope rigged equipment. Speeds have been stepped up... loads boosted. As a result, wire rope has been called on to meet increasingly severe service.

For many applications where service conditions are severe, ROEBLING "Blue Center" WIRE ROPE has exactly met requirements. *It has proved conclusively that it assures lowest general average operating cost.*

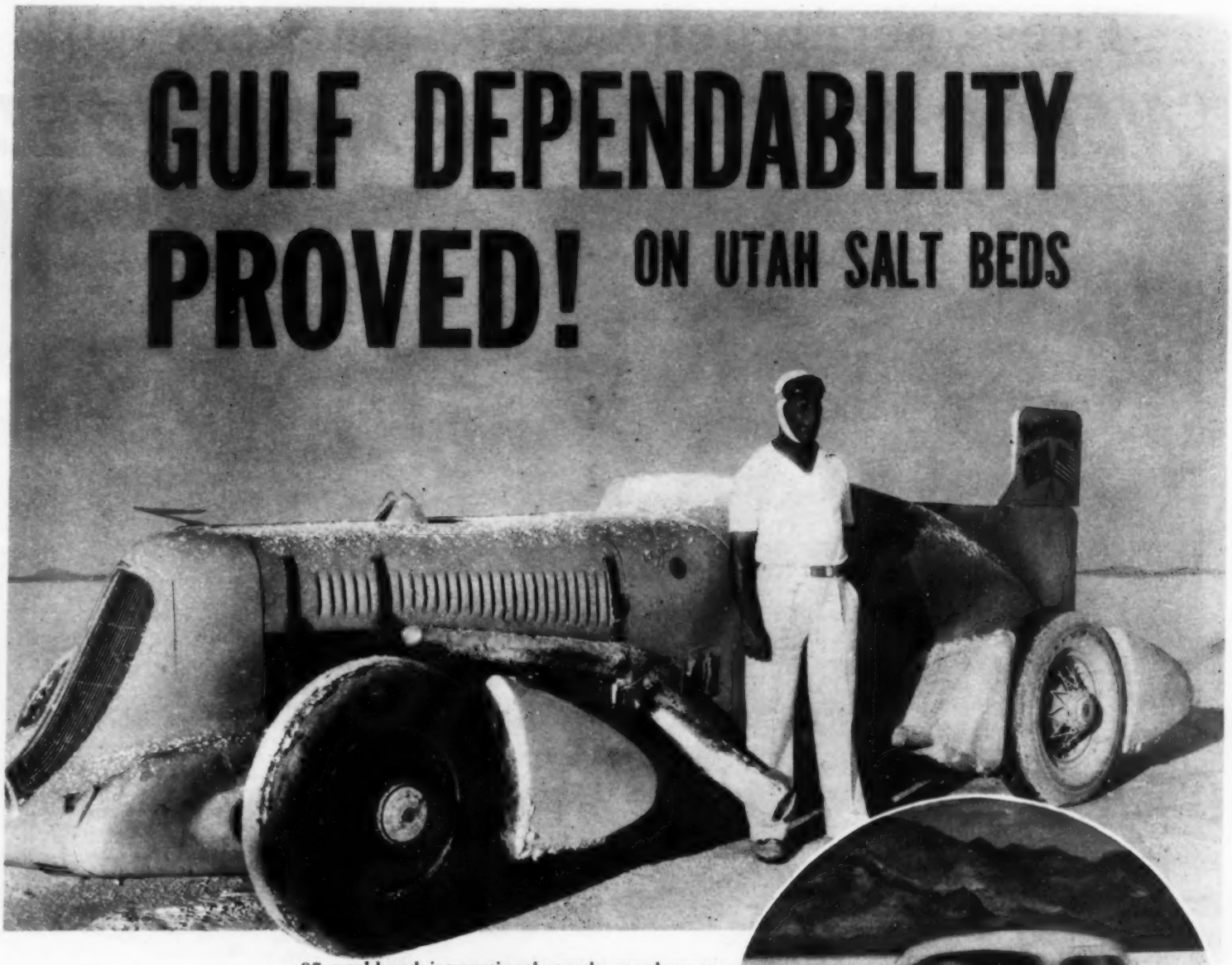
If you are seeking a wire rope of superlative quality, one which will give you maximum safety and durability, at rock-bottom operating cost, investigate Roebling Blue Center... *the highest development in Roebling wire rope manufacture!*

JOHN A. ROEBLING'S SONS CO.
TRENTON, N. J. *Branches in Principal Cities*


The Highest Development in Roebling Wire Rope
1 STRONGER
Wire of highest strength consistent with ductility and toughness
2 TOUGHER
Provides maximum resistance against wear, sudden shocks, vibration
3 SAFER
Unequalled for uniformity of quality
4 SAVING
Insures lowest general average operating cost

**ROEBLING ✸ BLUE CENTER**

# GULF DEPENDABILITY PROVED! ON UTAH SALT BEDS



87 world and international speed records were smashed by Ab Jenkins in his powerful racing car shown above—raising world's unlimited 24-hour record to average of 157.27 m.p.h. He also broke the 1-hour record at a speed of 177.05 m.p.h.

★ ★ ★ ★

Car driven by Ab Jenkins photographed while breaking 36 "unlimited" and 36 "Class C" stock closed car records—all well above 100 m.p.h. For 24 hours he averaged 101.72 m.p.h.

## Ab Jenkins sets 159 new speed records .... using Gulfpride Oil and No-Nox Ethyl Gasoline

*(Supervised and timed by the Contest Board of the American Automobile Association)*

NO special lubricants or fuels were used by Ab Jenkins when he recently hung up 159 new speed records with his big racer and his stock car sedan on the Bonneville salt beds in Utah.

He used the same Gulfpride Oil and Gulf No-Nox Ethyl Gasoline that are giving thousands of car owners new motoring economy and satisfaction every day! *The same gas and oil you can buy for your car from any Gulf dealer!*

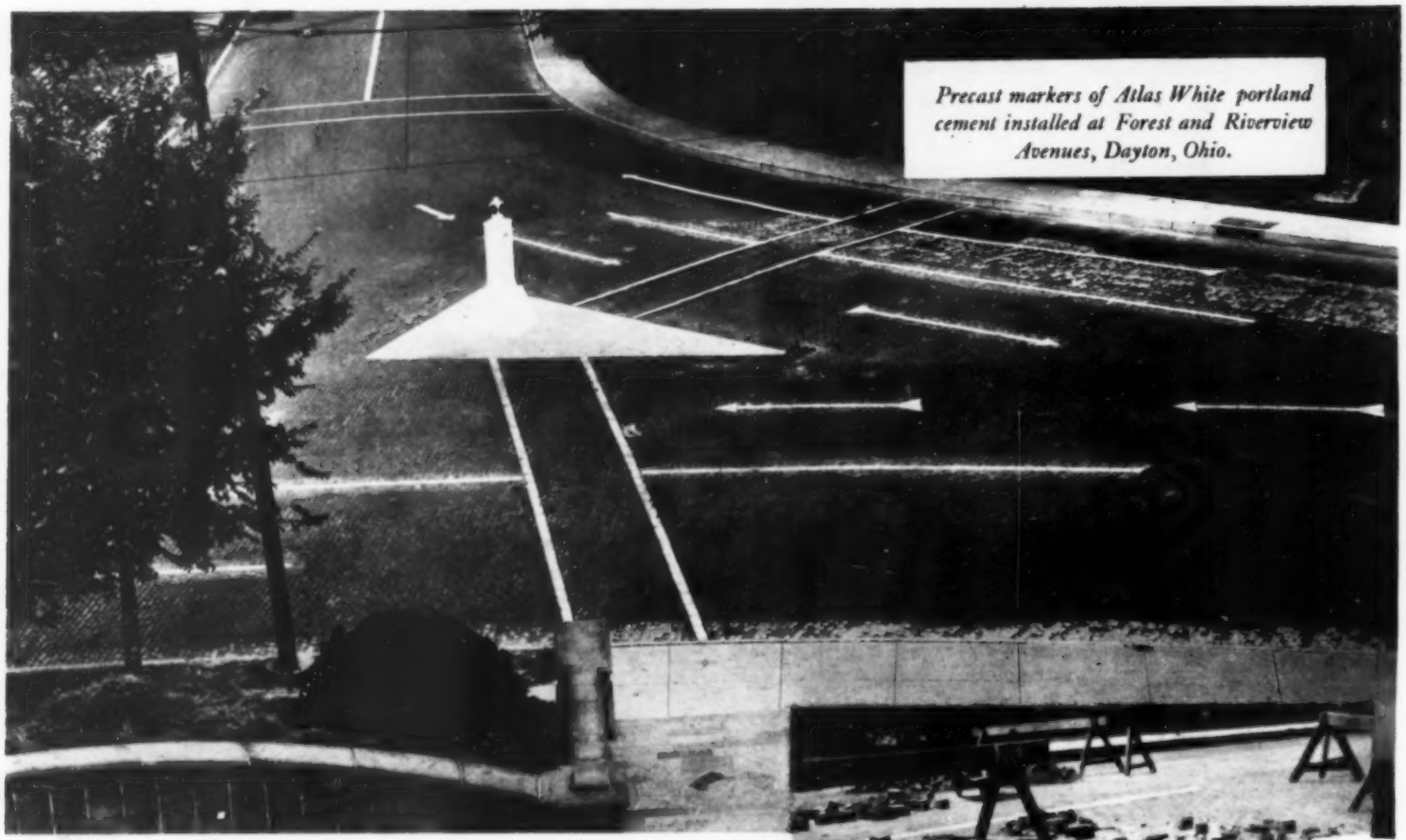
Gulfpride Oil has unique qualities which make it an ideal lubricant for all operating conditions. It is refined by a special process — Gulf's exclusive and patented Alchlor process — which removes 20% more waste, carbon, gum and sludge-forming elements. The result is an oil of greater stability, greater resistance to oxidation, better lubricating qualities and longer life.

*This same refining process is used in the preparation of Gulf's finest industrial lubricants.* Thus, operators of steam turbines, air compressors, Diesel engines and many other types of industrial equipment can secure for their engines and machines the same protection against friction, wear and repair expense that Ab Jenkins received from Gulfpride Oil when he made 159 new speed records in Utah. GULF OIL CORPORATION, GULF REFINING COMPANY, GENERAL OFFICES, PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

# These permanent white markers will

# NEVER HAVE TO BE REPLACED



*Precast markers of Atlas White portland cement installed at Forest and Riverview Avenues, Dayton, Ohio.*

THERE'S only one type of traffic marker that stays white permanently—the marker made of white portland cement and white aggregate.

It not only stays white without maintenance—it never requires replacement because it lasts as long as the pavement lasts.

Moreover, these markers actually *pay for themselves* over a period of years. And then they *continue* to save each year the cost of all maintenance otherwise needed.

Being *built* white, with a smooth, dense, hard white surface, they resist staining, and each rain washes them clean of surface dirt.

In winter months, installation of Atlas White markers (and curbs) can go right ahead. Precast sections are quickly and easily placed even in zero weather. Made indoors, they are simply moved to the job and set in place. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South LaSalle Street, Chicago.

## EASILY, QUICKLY INSTALLED

**(ABOVE) Precast arrows of Atlas White portland cement were installed in existing brick pavement.**

•

**(RIGHT) On the same job, precast markers of Atlas White portland cement were set in existing asphalt pavement.**

M-16

## ATLAS WHITE PORTLAND CEMENT

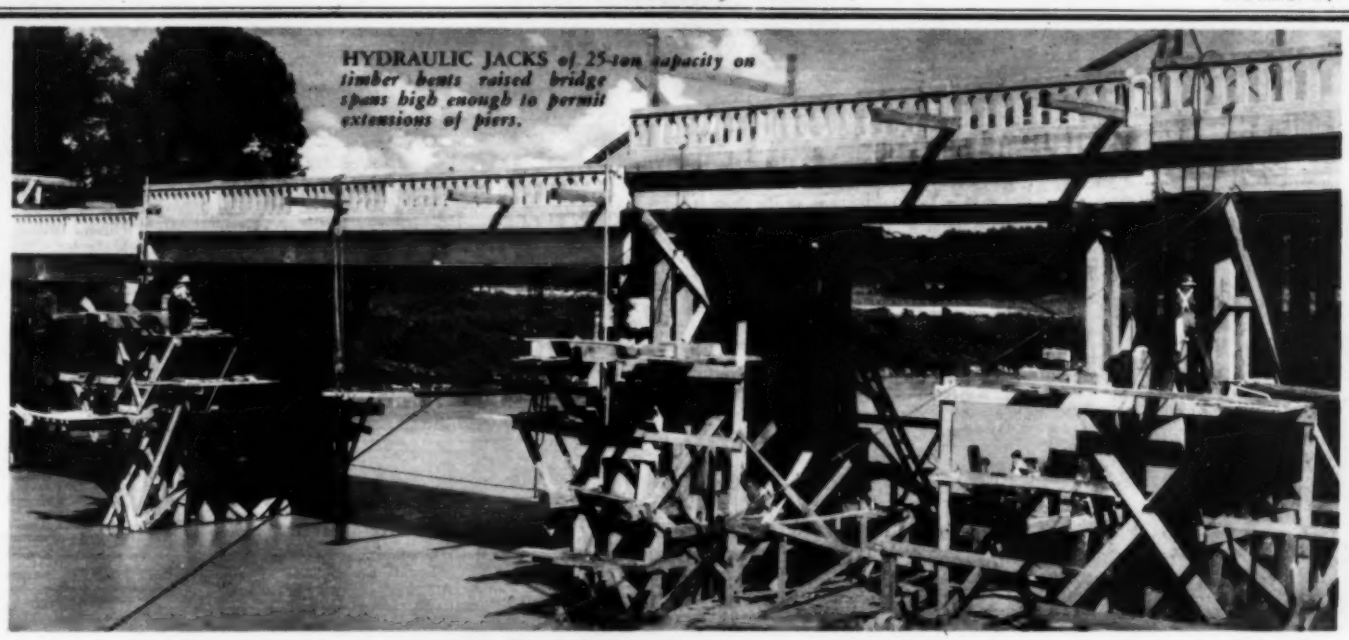
### FOR TRAFFIC MARKERS

# Construction Methods and Equipment

Established 1919 McGraw-Hill Publishing Company, Inc.

ROBERT K. TOMLIN, Editor

Volume 19 **November, 1937** Number 11

HYDRAULIC JACKS of 25-ton capacity on timber bents raised bridge spans high enough to permit extensions of piers.

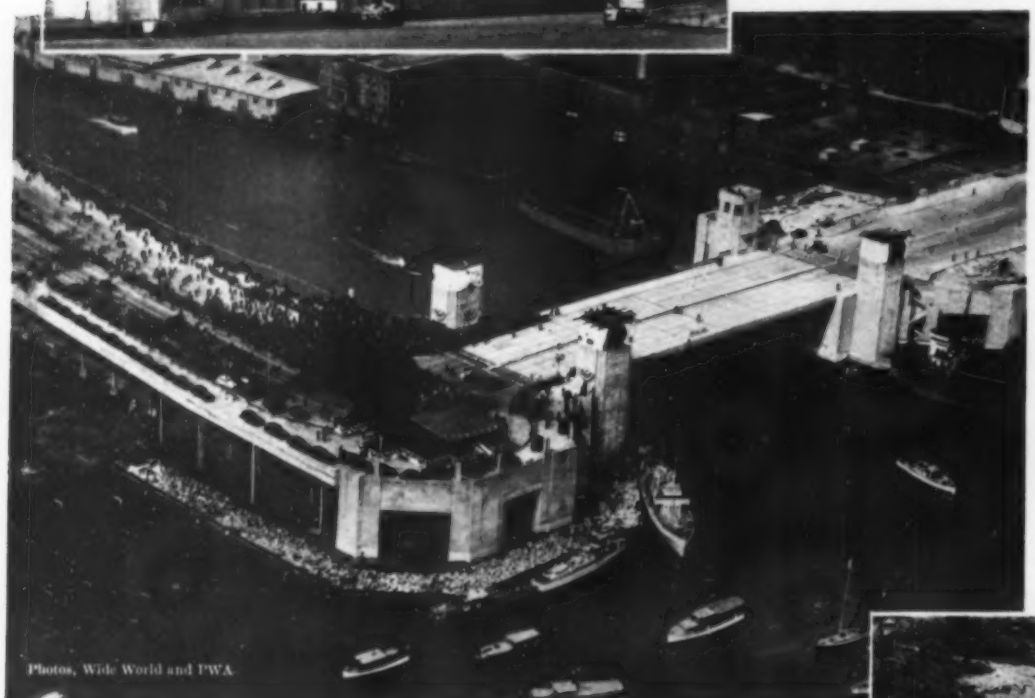
## Bridge Raised To Clear Reservoir

RAISING the 288-ft. long Bear Creek bridge on Alabama highway No. 20 an average of 4½ ft. is typical of the extensive relocation operations the Tennessee Valley Authority is conducting in the Pickwick Landing dam reservoir area.

The bridge is made up of three concrete deck girder spans 36 ft. long, and three I-beam spans 60 ft. long with concrete slab. The roadway width is 18 ft., supported by concrete piers.

Each span was raised by means of eight 25-ton hydraulic jacks. A timber bent was constructed near each end and braced to the existing superstructure. Four of the jacks were placed on each bent, and the span was raised high enough to permit the extensions to the substructure. Pony bents were then constructed on the jacking bents to support the spans while other spans were being jacked and the substructure extended. In extending the substructure, provision was made for supporting a future superstructure with a roadway of 20 ft. Each span was raised by a slightly different amount, by reason of the fact that the bridge was originally on a 1-per cent grade, while the final grade line will be level.

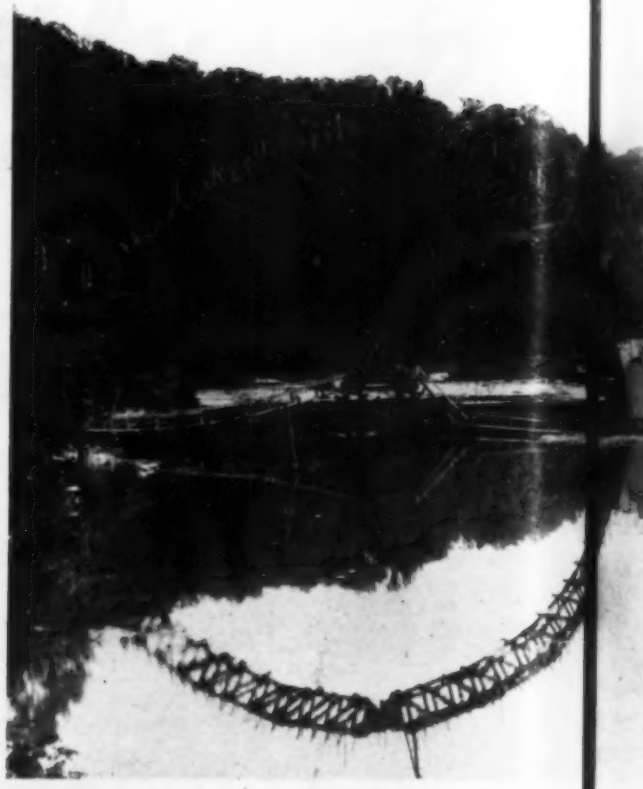
TIMBER BENTS were constructed to support raised spans of bridge while pier heights were being increased.



Photos, Wide World and PWA

## OUTERLINK BRIDGE

*(below and left), dedicated Oct. 5, closes gap in middle of Chicago's 30-mi. system of modern traffic-ways forming Outer Drive along Lake Michigan to bypass heavy traffic of Loop district. Structure costing $6,574,000, including PWA grant of $1,972,363, is double-leaf bascule with span of 220 ft. between piers. Roadway carries 8 traffic lanes and 2 sidewalks.*

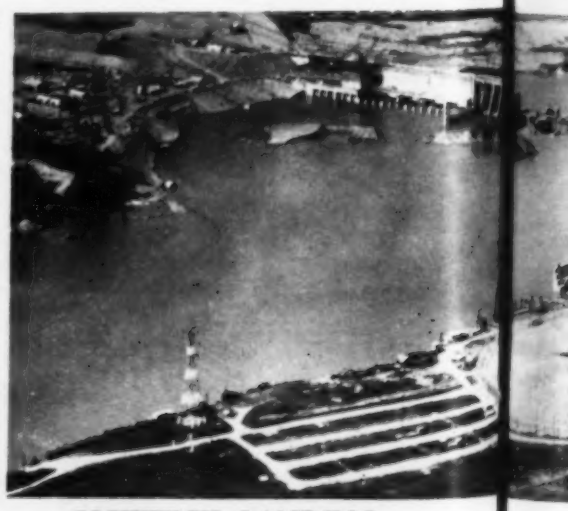


# This Month's "NEWS REEL"

Wide World Photo

## LINCOLN TUNNEL

*(left) south tube of which will soon be ready to carry vehicular traffic under Hudson River between New York and New Jersey, is scene of inspection "preview" ceremonies participated in by (1) former President Herbert Hoover (at microphone); (2) Frank C. Ferguson, chairman, Port of New York Authority; (3) Mayor F. H. LaGuardia, of New York City; (4) Attorney-General John J. Bennett, representing the Governor of New York; (5) State Senator Frank Durand, representing the Governor of New Jersey; (6) J. C. Evans, chief engineer, Port of New York Authority; (7) Harold S. Cullman, vice-chairman, Port of New York Authority; and (8) Mayor John G. Meister, Weehawken, N. J. Contractors for tunnel are Mason & Hanger Co., of New York City.*

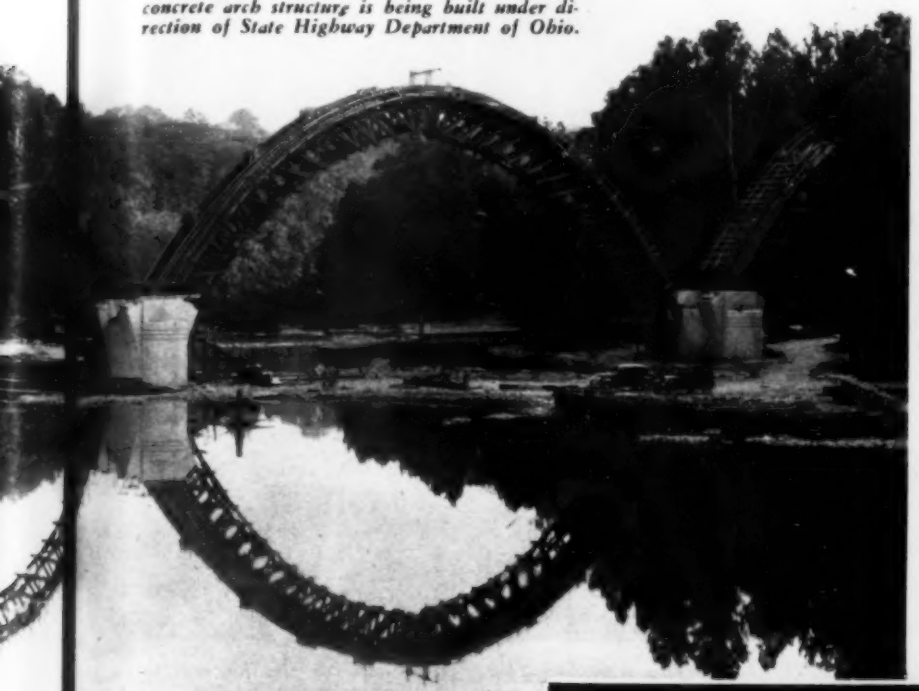


## PICKWICK LANDING DAM

*across lower Tennessee River swings into last lap of construction by forces of Tennessee Valley Authority. In midstream, steel sheetpile cylinders for third and last cofferdam are being*

## ARCH CENTERING

*for highway bridge at Foster, Ohio, is fabricated with aid of modern timber connectors, insuring strong, rigid joints in wood trusses. Multiple concrete arch structure is being built under direction of State Highway Department of Ohio.*



## GRADE ELIMINATION STRUCTURE

*(below) with fountain below level of traffic circle is scene, Oct. 12, of dedication of New York City's West Side improvement, a large-scale waterfront reclamation, major traffic artery and parkway project along Hudson River completed for 6.7 mi. between 72nd and Dyckman Sts. under direction of Commissioner Robert Moses of Department of Parks. Route has two 34-ft. separated concrete roadways.*

Wide World Photo

## TYGART DAM

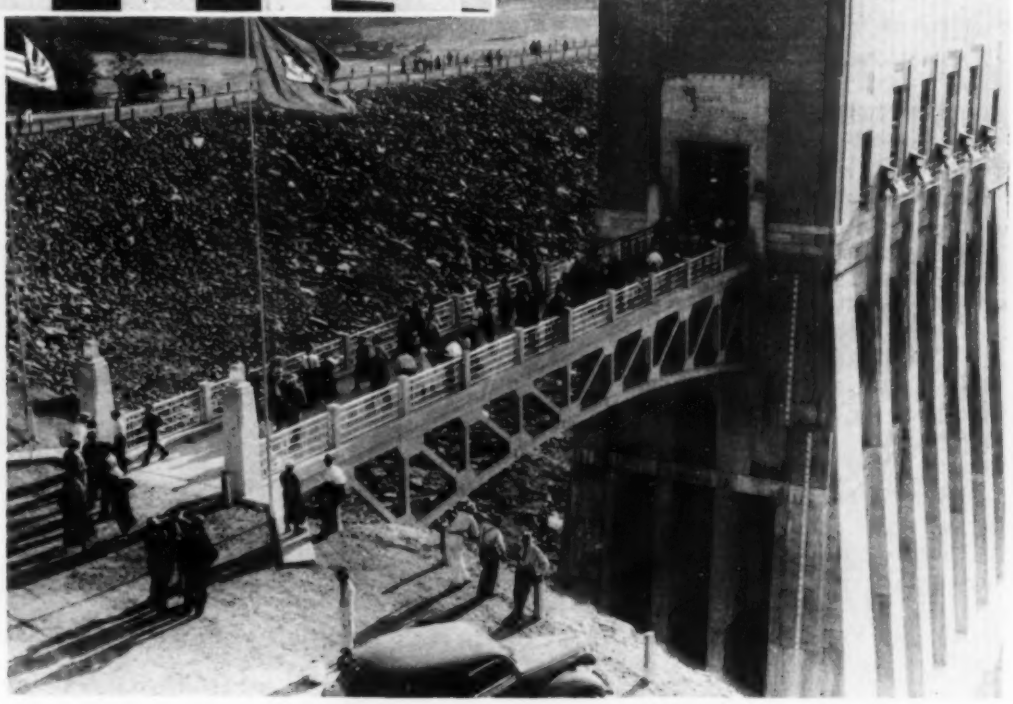
*(left) at Grafton, W. Va., has received its last bucket of concrete. Structure forming detention reservoir for flood control in Pittsburgh area is nearing completion, at cost of $6,249,000, by Frederick Snare Corp., contracting engineers, of New York, under direction of U.S. Engineer Department, Major W. D. Styer, district engineer. Dam with 490-ft. spillway has crest length of 1,850 ft. and maximum height of 240 ft. above foundation. Concrete was placed by gantry cranes operating on steel trestle embedded in completed structure. For the Snare Corporation Randall Cremer was resident manager.*

## PRESIDENTIAL INSPECTION

*(left) of Grand Coulee dam on Columbia River in Washington takes place Oct. 2. Frank A. Banks, construction engineer for U. S. Bureau of Reclamation, points out to President Roosevelt features of construction interest in project being completed by Mason-Walsh-Atkinson-Kier Co., contractors.*

## MOHAWK DAM

*(below) largest of structures forming 14 reservoirs for flood control in Muskingum Conservancy District in Ohio, is dedicated Sept. 23. Built under direction of U. S. Engineer Department by George M. Brewster & Son, Inc., of Bogota, N. J., rolled earth and rock fill structure is 111 ft. high and 2,330 ft. long.*



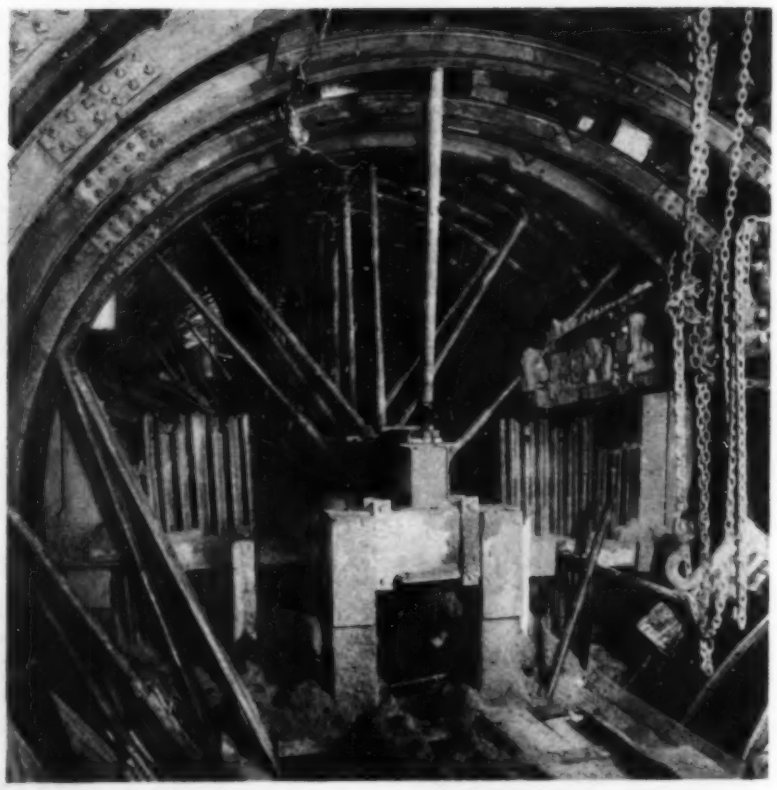
*driven. In foreground is radial aggregate storage plant with belt conveyor leading to mixing plant alongside land wall of 61-ft. lift navigation lock. Concrete is delivered to place by cableway spanning river. Completed dam will be 110 ft. high and 7,715 ft. long.*

# Special Methods

## *Aid Construction of*

# Buffalo's

# Large Sewer Program



SOFT-GROUND TUNNEL *for 11-ft. circular sewer on Division Ka advances through fine sand predrained from surface by vertical-shaft turbine pumps. Needle beam and radial jacks support steel plate lining ahead of ring beams and invert concrete.*

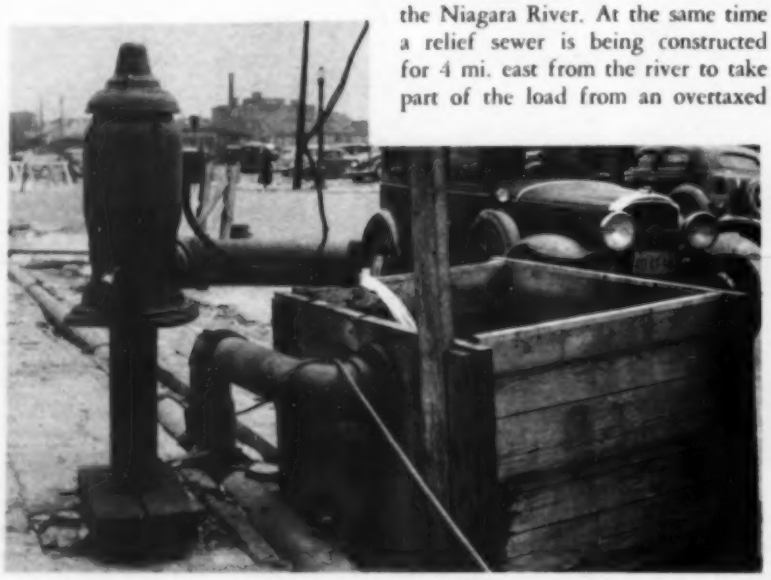
BELT CONVEYOR, *temporarily suspended from overhead trolley, operates on top of needle beam to carry muck back to hand car as miners advance top heading. Note steel liners blocked out from ring beams with concrete blocks and wooden wedges.*

A SINGLE DAY'S INSPECTION of 17 mi. of interceptor and relief sewers now being built by the Buffalo Sewer Authority in Buffalo, N. Y., reveals effective and economical methods of tunnel driving and open-cut construction which contractors have developed to facilitate operations on their respective contract divisions. Innovations and improvements over standard practice are observed in methods of predraining soft-ground tunnel, of delivering tunnel concrete through well casings from the surface and of handling muck both in open cut and in tunnel. A variety of conventional methods of excavating, sheeting, bracing and cofferdamming has served contractors in open cut on different divisions of the program. Full timbered tunnel and steel plate lining are being used in places where the sewers penetrate soft ground. In one soft-ground tunnel, needle beams in two headings support steel liner plates ahead of ring beams and invert concrete. All tunnels except one soft ground heading are driven in free air. Accompanying photographs illustrate certain features of the work.

*Buffalo's Sewer Program* — Up to the present Buffalo's sewers (carrying combined sanitary sewage and storm-water) have discharged directly into the Buffalo and Niagara Rivers. Under its current program, the Authority is building 13 mi. of interceptors extending from South Buffalo to the north end of the city to pick up dry-weather flow from the combined sewers and deliver it to a treatment plant under construction on Bird Island in the Niagara River. At the same time a relief sewer is being constructed for 4 mi. east from the river to take part of the load from an overtaxed existing sewer. Dry-weather flow in this new sewer will be caught by the interceptor.

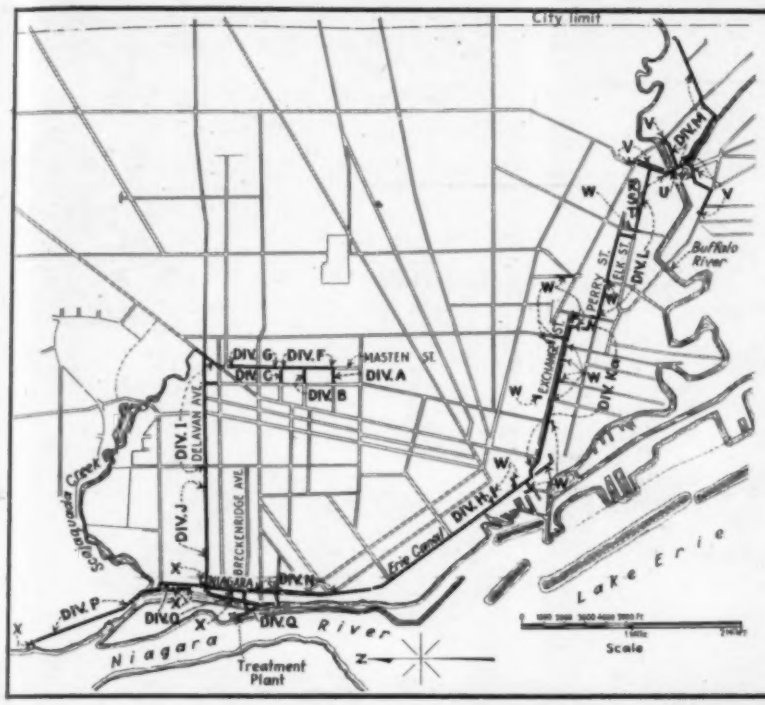
A grant from the Public Works Administration of 45 per cent of the project cost, together with bonds of the Buffalo Sewer Authority disposed of through PWA and private investment houses, is financing the $15,000,000 sewer and sewage plant construction. About $10,500,000 is being expended for sewers and about $4,500,000 for the plant.

*Concrete Pipe Sewers* — Starting at the extremities of the relief sewer and interceptors, the W. J. Irwin Construction Co. (Buffalo), Connelly Bros. (Cincinnati), and P. Tomasetti Contracting Corp. (Brooklyn), contractors for Divisions F, M and P, respectively, placed reinforced concrete pipe in open ditch, cut in earth to maximum depths of about



VERTICAL-SHAFT TURBINE PUMP *pulls groundwater from below invert grade of tunnel driven through sand soil under Exchange St.*

TUNNEL CONCRETE *(right) passes from truck mixer into 12-in. well casing through which it drops to tunnel placer on Division O.*




**BUFFALO SEWER PROJECT** *involves 17 mi. of sewer construction —13 mi. of interceptors parallel with rivers and 4 mi. of relief sewers, in Delavan Ave. and Masten St. For construction purposes, project is broken into contract divisions, as noted on map and in tabulation at right.*

**Contractor, Bid Price and Description of Sewers**

**(A, B) . . . Fahning Contr. Co., Buffalo, N. Y. $41,255. R.C. pipe in open cut: 1,492 ft. of 60-in. and 42-in.**

**(C) . . . LaMacchia & Guadagnino, Buffalo, N. Y. $16,900. R.C. pipe in open cut: 725 ft. of 42-in.**

**(F) . . . W. J. Irwin Const. Co., Buffalo, N. Y. $109,718. R.C. pipe in open cut: 2,380 ft. of 60-in. and 8 ft. of 42-in.**

**(G) . . . E. R. Morehouse Co., Camden, N. J. $228,014. Monolithic 7¾x6-ft. rectangular sewer: 1,488 ft. in open cut and 40 ft. in earth tunnel. R.C. pipe in open cut: 1,008 ft. of 78-in.**

**(H) . . . Merritt-Chapman & Scott Corp., New York, N. Y. $738,340. Semi-elliptical 11½ ft. sewer: 8,597 ft. in open cut. R.C. pipe in open cut: 334 ft. of 96-in.**

**(I) . . . Frazier-Davis Const. Co., St. Louis, Mo. $1,144,642. (Kalill Co., Cleveland, Ohio, sub on earth tunnel). Rock tunnel: 4,400 ft. of 11-ft. and 8½-ft. horseshoe sewer. Earth tunnel: 1,477 ft. of 11-ft., 8½-ft. and 8-ft. 2-in. horseshoe. Open cut: 1,398 ft. of 8-ft. 2-in. horseshoe and 509 ft. of 96-in. R.C. pipe.**

**(J) . . . Frank L. Cohen, Buffalo, N. Y. $659,025. Rock tunnel: 5,516 ft. of 12-ft. horseshoe sewer.**

**(Ka) . . . Henry W. Horst Co., Philadelphia, Pa. $1,555,112. Open cut: 7,808 ft. of semi-elliptical 11-ft. sewer. Earth tunnel: 1,410 ft. of circular 11-ft. sewer and 276 ft. of 11-ft. semi-elliptical.**

**(L) . . . P. W. Graham Contr. Co., Cleveland, Ohio. $702,240. Semi-elliptical sewer in open cut: 5,407 ft. of 11-ft. and 2,906 ft. of 9-ft. R.C. pipe in open cut: 1,386 ft. of 78-in.**

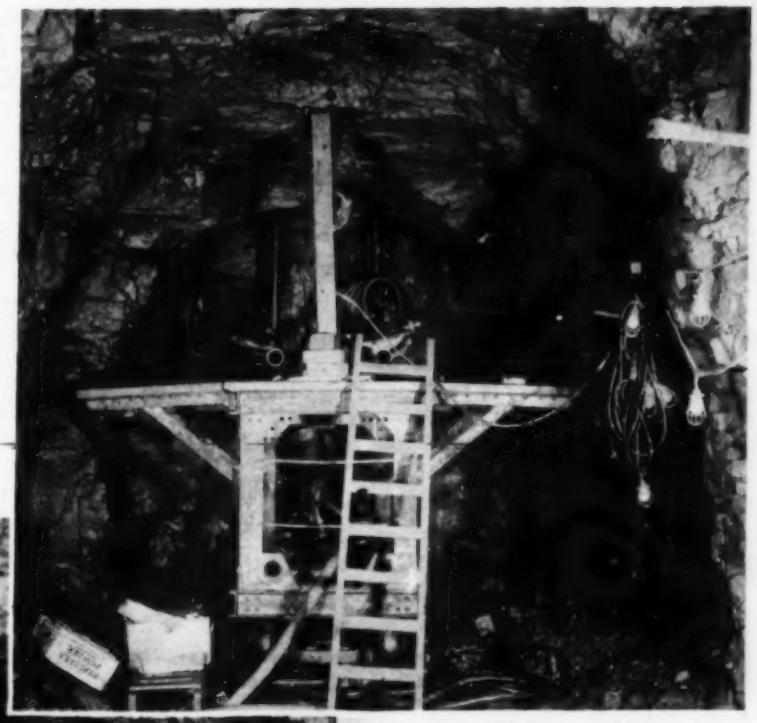
**(M) . . . Connelly Bros., Cincinnati, Ohio. $368,595. R.C. pipe in open cut: 9,445 ft. of 42-in. and 2,027 ft. (total) of 24-in., 54-in., and 78-in. Earth tunnel: 194 ft. of 42-in. circular.**

**(N, O) . . . Frazier-Davis Const. Co., St. Louis. $1,286,561. (Kalill Co., Cleveland, sub on earth tunnel). Rock tunnel: 300 ft. of 12-ft., 504 ft. of 11-ft. 5,669 ft. of 9-ft., 1,881 ft. of 8-ft., and 1,300 ft. of 6½-ft. horseshoe sewer plus 517 ft. of 42-in. circular sewer. Earth and rock tunnel: 1,039 ft. of 6½-ft. circular sewer. Earth tunnel: 118 ft. of 6½-ft. horseshoe sewer. Open cut: 147 ft. of 12x15-ft. rectangular and 50 ft. of 9-ft. horseshoe.**

**(P) . . . P. Tomasetti Contr. Co., Brooklyn, N. Y. $317,958. (Frank G. Hanssel Co., Buffalo, sub on stream crossing). R.C. pipe in open cut: 4,597 ft. of 84-in. and 2,066 ft. of 78-in.**

**(R, V, W, X) . . . P. Tomasetti Contr. Co., Brooklyn, N. Y. $682,498. (McLain Const. Corp., Buffalo, sub on Div. R. Frank G. Hanssel Co., Buffalo, sub. on Div. X.) Pumping station (Div. R) and special structures. R.C. pipe in open cut: 930 ft. (total) of 78-in., 54-in., and 30-in. Vit. tile: 7,114 ft. (total) of 20-in. to 10-in.**

**(U) . . . LaMacchia & Guadagnino, Buffalo, $76,985. River crossing in tunnel: 208 ft. of 4-ft. by 6-ft. 5-in. monolithic and 208 ft. of 36-in. R.C. pipe. Connections in open cut: 96 ft. of R.C. pipe (24-in. to 78-in.) and 67 ft. of 4x6-ft. monolithic.**



**FULL FACE** *of rock tunnel for 12-ft. horseshoe sewer on Division J is drilled with aid of carriage carrying platforms and columns for drilling upper half of bore.*

**WET DRILLING** *with drifters and jackhammers advances top heading and bench in rock tunnel for 8½-ft. horseshoe sewer on Division I in Delavan Ave.*

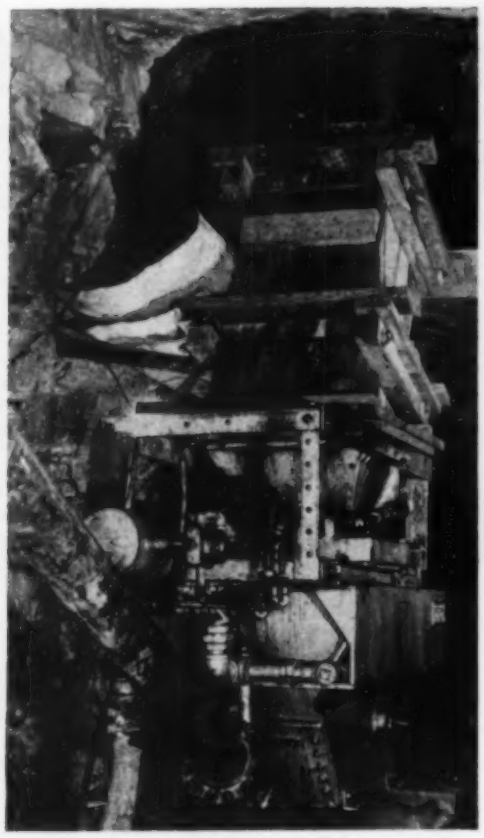
26 ft., with invert grade in some places lying 8 to 10 ft. below water level. On Division F, the W. J. Irwin Construction Co., with a ladder-type trenching machine, successfully excavated open ditch for 5-ft.-diameter reinforced-concrete pipe sewer to depths of 20 ft. below the street surface, holding the sides of the trench with tight sheeting after lowering the groundwater level by means of well points connected to header pipes placed alongside the curbs.

On adjacent Division G, the E. R. Morehouse Co., in addition to constructing 1,500 ft. of monolithic rectangular sewer, laid more than 1,000 ft. of 6½-ft.-diameter concrete pipe in deep ditch excavated in part by a steam shovel mounted on a rail carriage straddling the trench. This contractor held the sides of the trench with tight sheeting placed in two lifts and drained the soil with well points installed inside the first tier of sheeting and connected to header pipes resting on the shoulder between the two lifts, as illustrated by an accompanying photograph.

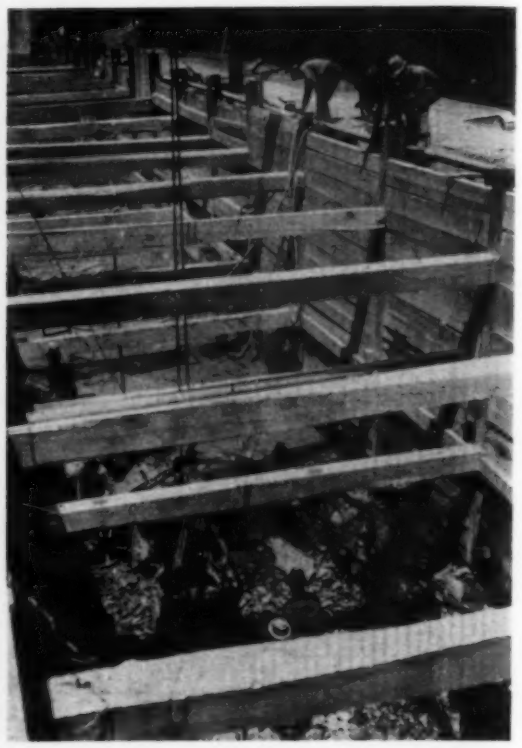
In Division M, South Buffalo, well points were not required, and trench drainage was removed by pumps and well constructed tile underdrains. Connelly Bros. excavated with backhoes and sheeted the trenches with timber. Practically all the pipe on this section was in 42- and 24-in. sizes. The crossing of Cazenovia Creek was made with parallel lines of 27- and 54-in. reinforced-concrete pipe. The contractor cofferdammed half the crossing at a time with steel sheeting and laid the pipe in open cut. A similar method is being used on Division P by a subcontractor, the Frank G. Hanssel Co., in carrying the Tomasetti sewer under Scajaquada Creek, with the exception that this contractor cofferdammed the entire crossing and diverted the creek around the construction.

Wet conditions on Division P, where the sewer follows the edge of the harbor and the filled bed of the old Erie Canal, caused the P. Toma-

LIGHT WAGON DRILL *mounted on three pneumatic tires puts down vertical blast holes in rock trench on Division Ka.*



PNEUMATIC CONCRETE PLACER *set up in tunnel at base of 12-in. pipe from surface shoots concrete through inclined riser at left into tunnel lining forms on Division I.*



HORIZONTAL SHEETING *10 ft. long installed between H-column piles on 10-ft. 2-in. centers holds earth sides above rock trench excavated to 26 ft. below street surface on Division Ka.*

setti Contracting Corp. to sheet its trench with steel piling and excavate with clamshells. Pipe sizes on this contract are 6½ and 7 ft.

*River Crossing* — At the west end of Division M, not far from Connelly Bros.' Cazenovia Street crossing, two Buffalo contractors, La-Macchia & Guadagnino, have elected to use an alternative method of crossing under the Buffalo River. The contract permits this crossing to be constructed either in open cut or in tunnel, and the contractors now are sinking shafts to limestone bedrock as the first step in driving a rock tunnel under the river.

*Open-Cut Construction* — On Divisions L and Ka the P. W. Graham Contracting Co. and the Henry W. Horst Co. are building more than 2 mi. of monolithic 9-ft. and 11-ft. semi-elliptical sewer in open cut. In partial rock cut the P. W. Graham Co. drives vertical timber sheeting on both sides of the trench as excavation proceeds and holds the sheeting with timber rangers and braces. In full earth cut this contractor continues to use vertical sheeting but places the rangers between 8-in. H-section steel piles driven 4 ft. below trench bottom for a toe hold. Three trench crews on Division L excavate earth and some rock with clamshells. In one rock cut a small revolving shovel on the bottom of the trench loads broken rock into muck skips. Using 40 ft. of steel arch forms, each of the three sewer construction crews on Division L completes about 100 lin. ft. of sewer per week.

A rented air-powered pavement breaker was observed in action on this division. This machine consisted of a pneumatic ram and an air compressor mounted on a steel turntable frame on a motor truck. The powerful quick-acting ram, controlled by a hand lever, punched holes in the asphalt top and concrete base of the pavement with a few sharp blows and speedily demolished the slab for handling by the excavators. Other contractors on the sewer program rented the same unit for pavement demolition.

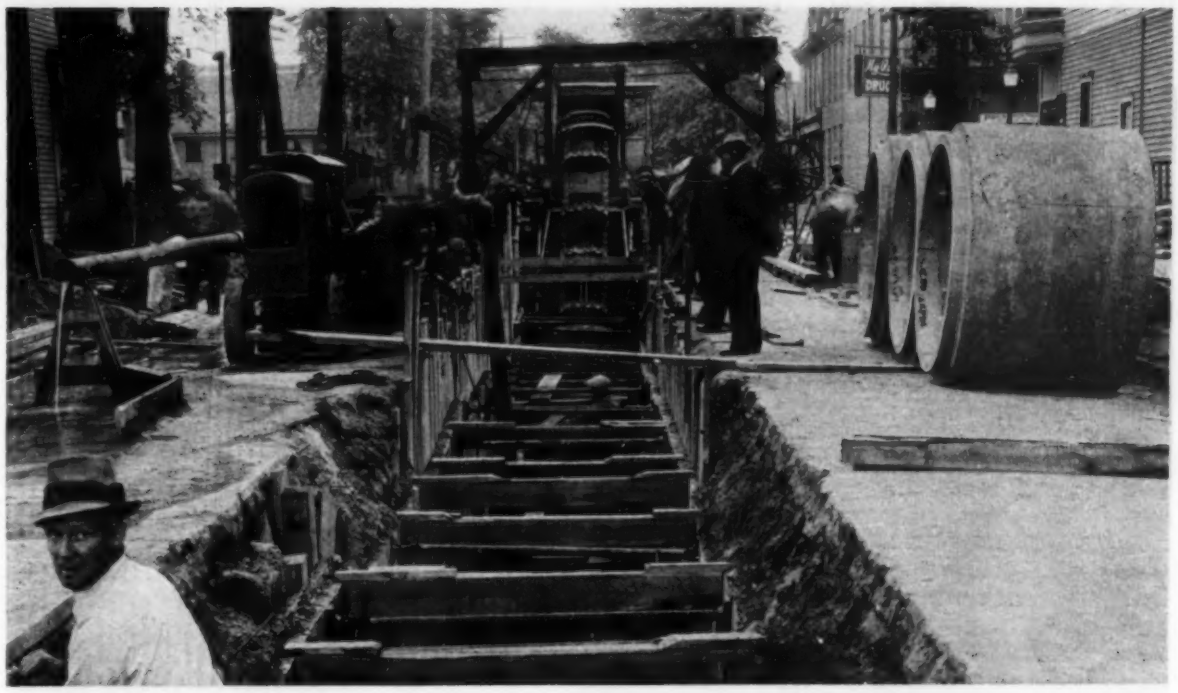
Open cut on Division Ka (the Henry W. Horst Co.) includes a short section in the filled bed of the abandoned Erie Canal. Here the contractor used steel sheeting in the trench as a precaution against bad ground and water conditions. Elsewhere on the contract, trench is sheeted with horizontal timber lagging installed between 8-in. H-beams driven in advance of excavation. On the day of the inspection, rock trench was being excavated at two points on this division. At one place, earth overburden and broken rock in the lower part of the trench were being excavated with clamshells, but at the second location a tunnel mucking machine was in po-

WET CLAY *in full earth cut on Division L is dug with clamshell. Timber rangers strung between steel H-piles hold vertical sheeting driven to depth of about 15 ft. Below this depth, workman is setting horizontal sheeting inside flanges of H-section posts.*

TUNNEL MUCKER *used in open rock cut on Division Ka facilitates loading of blasted rock into muck bucket on railway car.*

**STEEL SHEETPILE COFFERDAM** *for Cazenovia Creek crossing on Division M uses 30-ft. piling driven about 3 ft. below subgrade in stiff red clay.*

**DRAGLINES AND BACKHOE** *excavate unsheeted trench with sloping banks in filled bed of old Erie Canal on Division H. Completed sewer of Division Ka appears in background.*



**LADDER-TYPE TRENCHER** *and pipe-laying gantry aid construction of 5-ft. diameter concrete pipe sewer on Division F.*

sition to load rock into muck buckets carried on railway cars in the trench. The cars were moved by hand to a point where a crane on the surface could lift and dump them into overhead bins from which trucks took loads of spoil.

A tunnel mucker for open-cut excavation was used first in Buffalo by the Frazier-Davis Construction Co. on the Main St. portion of Division I, of the relief sewer. The mucking machine, in combination with a crane on the surface, can move rock much faster than straight clamshell digging or handloading.

Small wagon drills mounted on pneumatic tires expedite drilling operations in rock cut for the Henry W. Horst Co. The same type of equipment served the Merritt-Chapman & Scott Corp., which has completed the contract on adjacent Division H in the bed of the old Erie Canal. The latter contractor dispensed with sheeting and excavated open trench in filled ground with draglines. Aided by an open winter, called by local residents the mildest in 50 years, the Merritt-Chapman & Scott Corp. with three construction crews and two 100-ft. steel forms was able to maintain an average of 100 ft. of completed monolithic sewer per day through the winter months.

*Soft-Ground Tunnel*—A 1,700-ft. tunnel in sandy soil on the Henry W. Horst Co. contract is being driven in two directions from a shaft through ground which has been predrained by four to six 6-in. vertical-shaft turbine pumps. These pumps are set up in drilled and cased holes with a slotted and screened pipe section at the lower end of the casing. The pumps are moved ahead as tunnel driving progresses, and at least one pump always is kept ahead of the heading to assure predraining of the soil. Normal groundwater level is within 2 or 3 ft. of the top of the arch in the tunnel. By draining with well pumps to depths of 5 or 6 ft. below the invert, the contractor has drawn the groundwater level below invert grade.

This method of predraining proved entirely successful in driving the west heading 300 ft. in coarse sand to a connection with the open-cut sewer in the old Erie Canal. In this part of the tunnel the sewer was built to 11-ft. semi-elliptical section, as originally designed. Because of the fine, wet sand encountered in driving 1,400 ft. east of the shaft the contractor requested permission to build 11-ft. circular section to re-

**OUTSIDE ARCH FORMS** *for 11-ft. semi-elliptical sewer on Division H are carried by traveling steel gantry.*

sist ground pressure. The engineers granted the request and prepared a circular design.

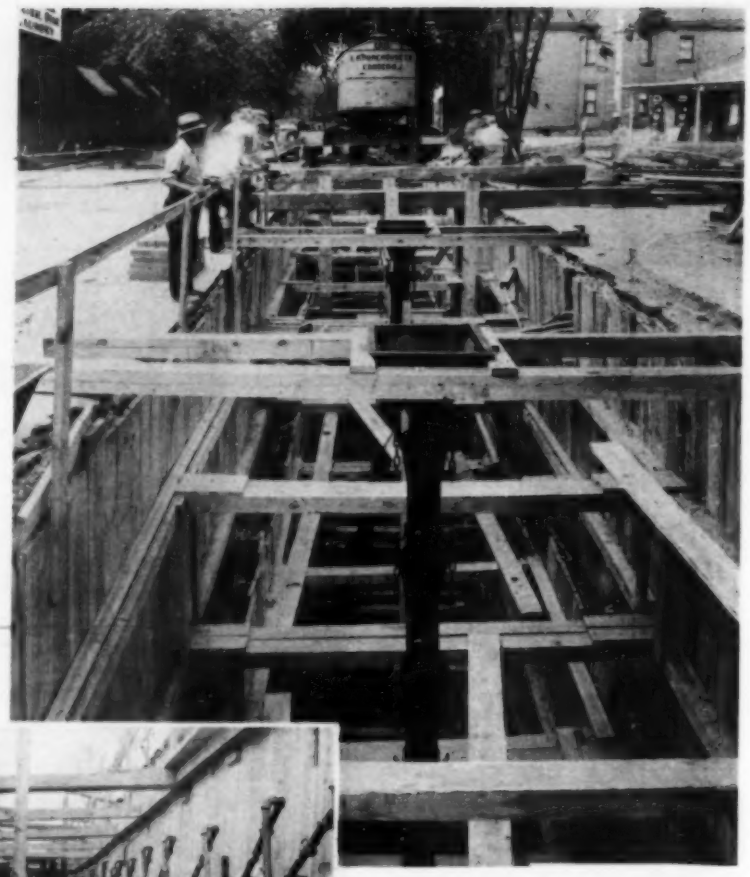
Predraining by well pumps proved successful in about 900 ft. of the east heading. Beyond this point the contractor was forced to use air pressure to overcome water conditions, as a mixture of fine sand and clay encountered in the lower portion of the heading prevented unwatering by the use of wells. An air pressure of 5 lb. to 7 lb. per square inch was employed, and it was expected that air would be used to drive the remaining 500 ft. of tunnel.

Both headings in this tunnel are lined with steel plates reinforced with ring beams. The tunnel is driven by the top-heading method, using needle beams and radial jacks to support the steel liners in advance of ring beams and invert concrete. A sand bench retained behind a bulkhead up to springing line supports the forward end of the needle beam, while the rear end is blocked up from invert concrete. When driving top in the east heading, the contractor saves shoveling back to the muck car by using a belt conveyor on the top flange of the needle beam. Muck cars are moved to the shaft by hand.

Although the soft-ground tunnel on Division Ka is probably the most difficult and most interesting on the Buffalo sewer program, other sections of soft-ground tunnel are found on Division I and Divisions N and O. The general contracts for these divisions, which consist almost entirely of tunnel, are held by the Frazier-Davis Construction Co., which sublet the soft-ground tunneling to the Kalill Co., of Cleveland. Specifications permit the use of full timbering or steel liner plates in soft-ground tunnel. The Kalill Co. installed timbering on Division I and steel plates elsewhere but lined its shafts on both Divisions I and O with steel plates.

*Rock Tunnels* — With the exception of the soft-ground sections which have been placed under subcontract, the Frazier-Davis Construction Co. is driving all the rock tunnel on Division I and on Divisions N and O, utilizing proved methods to advance the headings of horseshoe sewers of 6½- to 12-ft. size. Compressors, hoists, and pumps are electric-motor-driven. Drifter drills mounted on carriages are used for the drilling, and blasted rock is loaded with electric-motor driven mucking machines into cars drawn by storage-battery locomotives. Air-operated transfer hoists mounted on trolley beams pick empty cars off the track to let loaded cars pass. Fresn air is blown to the working faces through metal ventilating pipe.

On Division J, where Frank L. Cohen, of Buffalo, contractor, is driving more than a mile of rock tunnel for 12x12-ft. horseshoe sewer, similar methods are being used to advance the heading. This contractor drove the entire length of tunnel before starting the concrete lining. In the tunnels being built by the Frazier-Davis Construction Co., tunnel lining progresses some distance behind the face.



**HEADER PIPES** *of well-point drainage system on Division G rest on shoulder between two tiers of vertical sheeting. Flexible vertical spouts are in place for dropping truck-mixed concrete. In background is steam shovel on flanged-wheel steel gantry straddling ditch.*

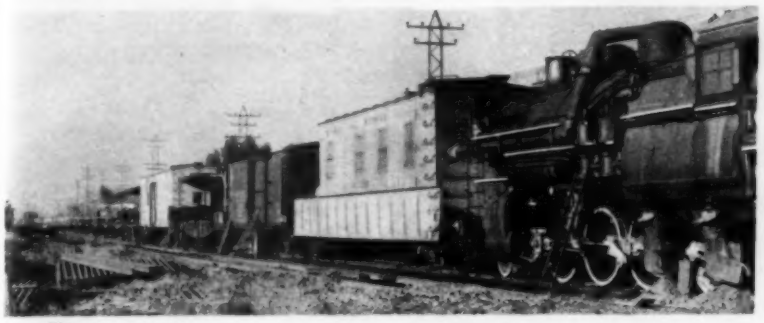
**WELL POINTS** *on Division G are installed below street surface, with header pipes resting on crossbracing at top of lower lift of sheeting.*

**SHEETED TRENCH** *in open cut about 25 ft. deep enables contractor on Division M to place 78-in. reinforced-concrete pipe sewer approaching Buffalo River, in background, to invert grade 8 ft. below river surface.*

*Concrete Delivery*—All the contractors on the sewer program find it economical to buy commercial ready-mixed concrete delivered in truck mixers. In the tunnels, to save hauling from the shafts, the contractors sink cased well holes from the surface through the tunnel roof at convenient points. Concrete is discharged by the truck mixers into the pipes, which deliver it directly to pneumatic placers set up in the tunnel.

*Administration* — Greeley and Hansen, Chicago, are designing and supervising engineers for the Buffalo Sewer Authority. C. R. Velzy, resident engineer, represents this firm in Buffalo. The interceptor sewers are being built under the direction of Greeley & Hansen, with F. C. Sellnow as resident engineer of construction. Work on the relief sewers is being done under the supervision of the Sewer Department of the Division of Engineering in the Buffalo Department of Public Works, with C. L. Howell, assistant city engineer, in direct charge and with Greeley & Hansen as consultants. George J. Summers is commissioner of the Department of Public Works. Engineering activities of the Buffalo Sewer Authority are coordinated under the direction of Edward P. Lupfer, directing engineer.

# *Step-by-Step Field Methods*~Rail Welded in Long Strings Produces "VELVET" TRACK

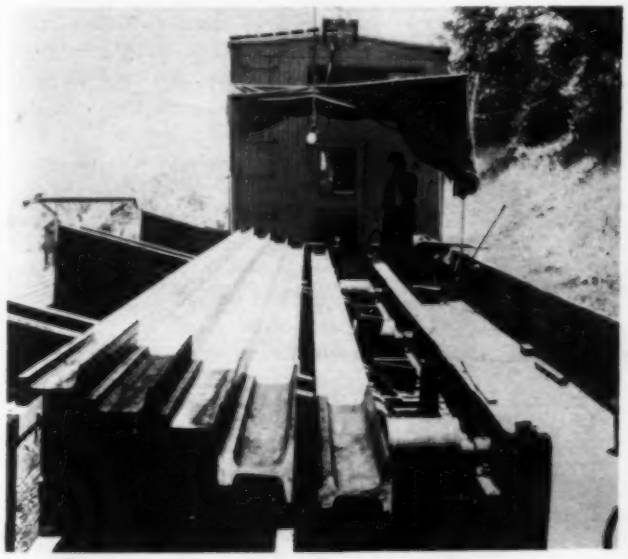


**1** RAIL WELDING OUTFIT *includes locomotive supplying steam to turbo-generators, rack car, welder car and string of flat cars.*

ELECTRIC FLASH butt welding technique has been developed to join standard 39-ft., 131-lb. steel rails into continuous lengths of about 1,000 ft., eliminating the ordinary joints — and the cost of maintaining them — and producing a smooth-riding, "velvet" track for passenger and freight car service. This method of welding standard rail lengths end to end has been used extensively in Europe where, during the last 8 years, more than 200,000 flash welds have been put into service. In the United States today the Delaware & Hudson Railroad, under the supervision of H. S. Clarke, chief engineer, is laying a considerable quantity of welded track near Schenectady and Port Henry, N. Y., the actual welding being done by Sperry Rail Service of Brooklyn, N. Y., with Sperry and General Electric equipment. When laid in track the long strings of flash-welded rail are joined together by closure welds made by the Thermit process to give continuous rail punctuated only by the insulated joints required for signal service.

The equipment employed in Sperry flash welding involves a welding car, housing a specially constructed flash welding machine; a generator car, housing two turbo-generators for supplying current for the welding machine and auxiliary equipment; a steam locomotive for supplying steam for the turbo-generators; a rail-rack car for lining up rail preparatory to movement into the welder car; and a series of five flat cars on which are situated respectively a stress relieving oven and four grinders. Attached to the foregoing outfit, is a train of flat cars, or open gondola cars, on to which lengths of welded rail are hauled by means of a winch located at the rear of the train.

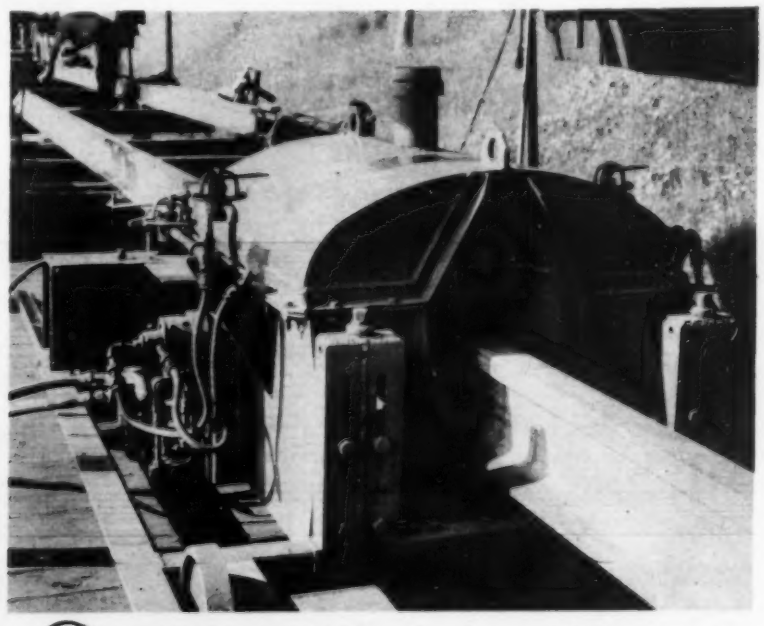
All operations are simultaneous; that is, while a weld is being made



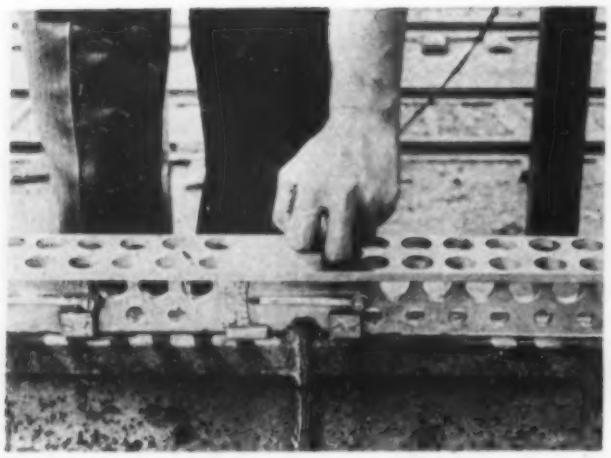
**2** RACK CAR *carries rails which are fed into welder car by power rollers.*

**3** GRINDING ENDS OF RAILS *in rack car cleans them for electrical contact.*

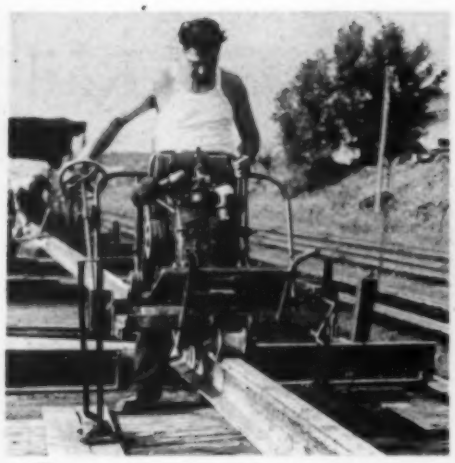
**4** FLASH WELDING *with automatic control joins rails in welder car into long, continuous strings.*



**5** ANNEALING FURNACE *on first flat car, behind welder car, relieves stress in welded rail joint.*



**6** ALIGNMENT GAGE *checks welded rail following stress-relieving operation. Upset metal at joint not yet ground off.*



**7** UPSET METAL *from sides of rail head is removed by gage grinder.*

**8** FILLET GRINDER *on third flat car removes upset metal below rail head and above base.*

in the welding machine, the weld previously made is being stress-relieved in the oven, and the four welds made prior to this are being respectively ground at the four grinding stations. One rail's length separates the stations.

The first, or gage grinder, removes upset metal from the sides of the rail head; the second, or fillet, grinder removes upset metal from the fillet beneath the rail head and from the portion immediately above base of rail. This removal of upset metal reduces chance of any fatigue fracture developing at these parts. The third, or intermediate, grinder removes part of the upset metal on the rail head. The fourth, or finishing, grinder smoothes off and contours the rail head at the point of weld.

Making the weld, stress relieving and grinding, may therefore be looked upon as a group of operations forming a complete cycle. Upon completion of each group of operations, the rail is hauled one rail's length along the flat cars, thus permitting all operators to start afresh without moving from stations. When fully loaded with approximately 12 strings of rail the flat cars bearing the welded rail are unhitched and the rail is transported to the site of laying.

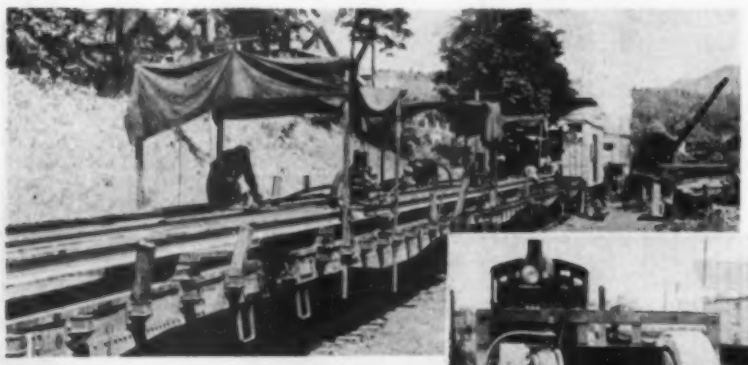
In order to unload a long string of welded rail from the flat cars, the end of the rail is attached, with a cable, to an anchorage on the ground. The train then is pulled from under the rail, and the rail is hauled off at the rear of the train.

Welded rail is sufficiently flexible to be transported in long strings that conform to curvature of track while on flat cars without the necessity of being fastened down in any way.

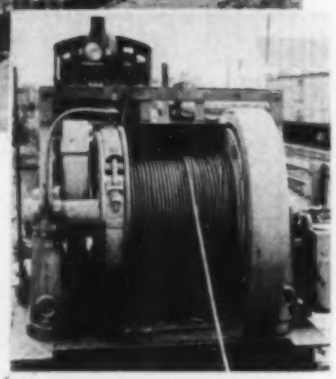
The flash welding machine (in the welder car) is essentially a two-part unit on a steel bed. One portion is rigidly fixed, while the other is a movable platten which supports the end of the rail to be welded to the

**9** TOP OF RAIL HEAD *is made smooth by rough grinding around upset metal.*

**10** FINISH GRINDING *completes smoothing and contouring of top of rail head.*



**11** TRAIN OF FLAT CARS *carries flash welding outfit. Awnings cover grinding stations as lengths of welded rail pass through.*



**12** WINCH *(right) on rear flat car hauls welded rail from welder car.*

**13** FLEXIBILITY *of long lengths of welded rail is demonstrated in this view of cars passing around 15-deg. curve.*

rails already joined into a long string. Both fixed and movable portions of the welding machine are equipped with hydraulic clamps which grip the rails and with electric contact pads.

Making the weld consists of three phases: (1) pre-heating; (2) flashing; (3) push up. In preheating, the rail ends are clamped in the machine, one in fixed position and the other movable. Current clamps are connected to a low-voltage transformer. Intermittent short circuiting between the two faces re-heats the rail ends. After preheating continuous short circuiting, or "flashing," burns off the high spots of the rail ends. After a predetermined amount of flashing the faces of the rail ends are brought together, or "pushed up" under great pressure. The molten metal is squeezed out and the weld is made between the plastic faces.

The generator car is a specially constructed steel box car which houses two steam turbo-generators. The steam demand for the turbine driving the generators varies from 15,000 to 22,000 lb. per hour, with pressure at the turbine nozzles between 175 and 200 lb. per square inch.

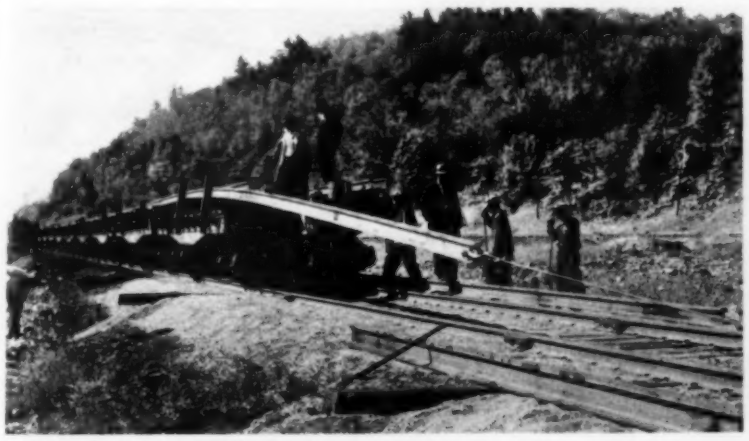
The Sperry flash butt weld takes approximately 6 min. to make. Only the original metal of the rail is employed.

Out on track, the "closure" welds, between strings of flash-welded rail, are made by the Thermit process, since it is not feasible to unload Sperry equipment for this purpose. In the Thermit process, a mold is built around the rails, at the joints, and molten metal is poured into the mold. The Thermit mold requires about 3 hr. to complete.

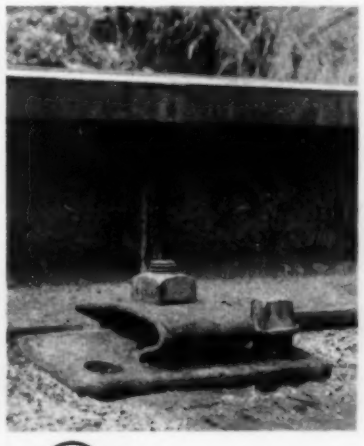
Welded rail in track is firmly fastened to ties by means of spring clips which exert a pressure of 2,500 lb. each on the base of the rail. The ties are firmly bedded in ballast. The resistance to movement exerted by the spring clips and bedded ties produces a force greater than any force inducing either expansion or contraction in the rail. Once laid in track, therefore, the welded rail remains rigid.

Among advantages claimed for the continuous lengths of welded rail are the following:

Rail joint maintenance eliminated.
Track maintenance costs reduced.
Rail life increased — no joint batter and less frequent rail laying.
Smooth riding for trains.
Rolling stock maintenance reduced because of absence of shock at rail joints.
Rail creeping eliminated.
Reduced tie deterioration, especially at joint ties.
Signal circuit bonds eliminated.



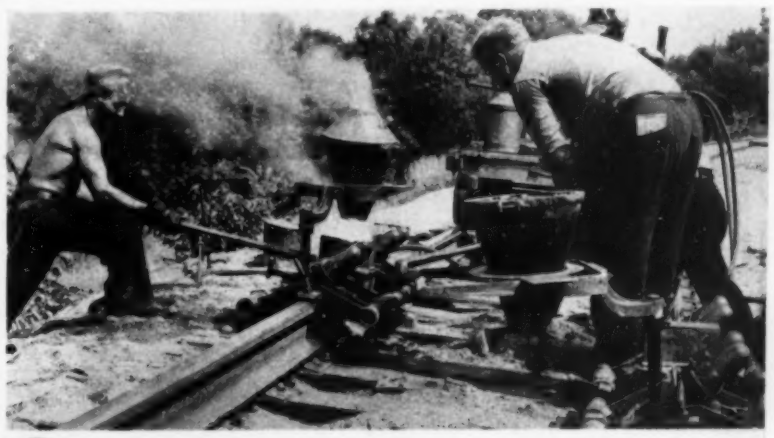
**14** UNLOADING *lengths of welded rail is done by fastening by cable to anchorage on ground and moving train forward.*



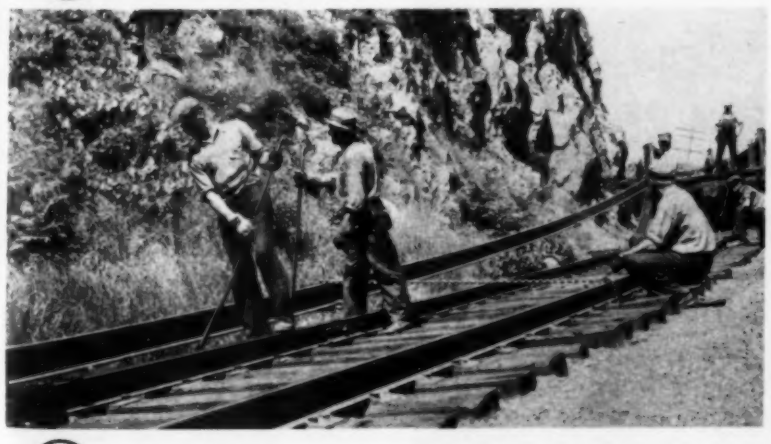
**17** TIE PLATE *and spring clip form connection between rail and tie.*

**18** CLOSURE WELD *between long lengths of flash welded rail is made by Thermit process.*

**15** LAYING WELDED RAIL *around curves in track offers no difficulty.*



**19** POURING METAL *into mold for closure weld by Thermit process.*



**16** DISTRIBUTING *continuous string of welded rail along track for installation.*

**20** "VELVET" TRACK *of smooth riding quality is produced by continuous lengths of welded rail.*

**THREE-BATCH MATERIAL TRUCKS** *deliver cement, sand and gravel to 27-E paving mixer. At right of paver tar paper sheets separating old brick surface and new concrete are being unrolled.*

**EXPANSION JOINT ASSEMBLY** *comprises ½-in. strip of preformed rubber, ⅝-in. dowels 2 ft. long, set on 12-in. centers, and copper seal at bottom where joint is in contact with subgrade.*

**TAR PAPER SHEETS** *are unrolled behind mixer to separate old brick surface and new concrete.*

*Worn Pavement Widened and*

# Salvaged With Concrete

SALVAGING EXISTING PAVEMENT that has worn out under modern traffic or has become inadequate to carry the increasingly heavy loads by resurfacing it with new materials is becoming more or less general practice. One such project is the resurfacing and widening of Route 2 from Elkhart to Goshen, Ind., known as Federal Aid Project 420-C.

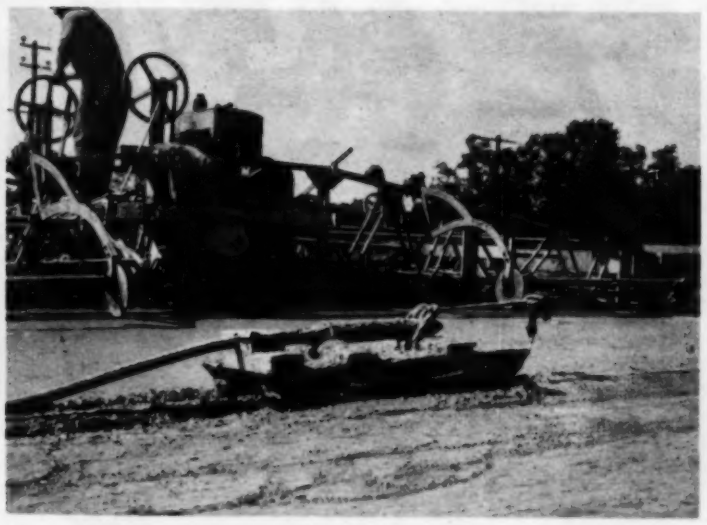
The project consisted in widening the existing 18-ft. road to 30 ft., resurfacing with a minimum 5-in. slab of reinforced concrete, and building sections of new 9-7-9-in. reinforced concrete slab where relocation was deemed advisable. Part of the old road was brick and part concrete. Approximately 2.3 mi. are old brick, 1.6 mi. old concrete and 2.6 mi. new concrete. Construction operations were practically identical on pavement laid over brick, over concrete, and for new pavement. Separation sheets of tar paper were placed between the old brick and new concrete. No separation sheets were placed between old and new concrete.

A minimum 5-in. slab over the irregular brick surface was specified. To insure this minimum thickness the old surface was cross-sectioned and critical grades were established. Levels were taken every 25 ft. longitudinally and at 2-ft. intervals at these stations laterally. Readings also were taken at high points between stations and the highest point in the 18 x 25-ft. section was established as the critical grade for that section. High points in successive sections were plotted and a grade established for the pavement surface. From these critical grades side forms were set. Variations in side form elevations of more than 0.01 ft. from critical grade were corrected by pulling the side-form pins and resetting the forms.

Separation sheets used were made of tar paper from 36 to 48 in. wide, weighing not less than 40 lb. per 1,000 sq.ft. The brick surface was first wet, the tar paper was laid with about a 1-in. lap, and concrete

**FINISHING MACHINE** *has double screed covering pavement width of 30 ft.*

INSTALLING *½-in. premolded rubber expansion joint with ⅝-in. dowel bars 2 ft. long spaced on 12-in. centers.*



VIBRATING SLED *drawn across pavement compacts concrete at transverse expansion joints.*

BROOMING *transversely produces roughened surface texture for concrete pavement surface.*

was placed directly on the paper. In unrolling the paper care had to be exercised in maintaining the proper lap and in keeping the paper from folding over irregularities in the surface of the brick or, when concrete was placed upon it, so as to avoid setting up planes of weakness in the concrete slab.

All concrete, both that in the resurfacing slab and that in the new sections, followed standard Indiana specifications. Proportions for each batch were: Cement, 620 lb.; sand, 1,320 lb.; small gravel, 1,386 lb.; and large gravel, 924 lb. The cement factor was held constant at 1.5 bbl. per cubic yard of concrete, the water ratio varying between 27 and 31 gal. per 6-bag batch. A maximum slump of 3 in. was permitted.

Concreting materials were sidetracked from the main line of the New York Central about midway of the job and trucked over the existing pavement to the point of concrete placement in 3-batch trucks. All materials for the entire project were proportioned at the central batching plant.

Concrete was placed for the full 30-ft. width. It was first struck off 2 in. below the finished surface, wire fabric reinforcing was placed, and the slab was brought to finished grade and struck off again. Following the final strikeoff came a double-screed finishing machine. The pavement next was Flex-planed, this machine substituting for a second finisher or a second passage of one finisher. The surface was then floated with a longitudinal float, the operators working from a double bridge. From the back of this bridge the alignment of expansion joints was checked. Surface irregularities were checked with long-handled straightedges, operators working from both sides of the pavement.

Some difficulty was first encountered in obtaining a satisfactory finish in the center of the pavement with the 10-ft. straight-edges, but this difficulty was overcome by hand floating the center from a bridge after straightedging. Surface texture was obtained by brooming. The pavement was cured first with burlap, which was left on for a maximum of 24 hr., then with wet straw.

There was little variation from this construction procedure in resurfacing over concrete. New construction followed standard practice.

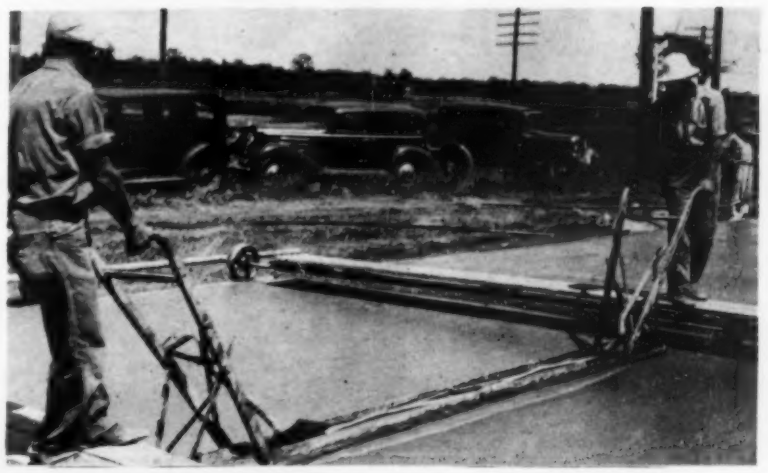
When concrete was hard enough to support a man's weight it was inspected for surface irregularities. Variations greater than ⅛ in., as revealed with a 10-ft straight-edge, were rubbed down with a hand stone while the concrete was still green. If the irregularity could not be eliminated before stone was reached the spot was marked and the high point taken down with a power machine.

The 12-ft. widened section was laid 9 in. thick at the outside edge, tapering within the next 2 ft. to 7 in. in thickness. Transverse expansion joints were spaced 40 ft. apart. Where the bottom of the expansion joint rested on the subgrade it was copper-sealed, the seal extending on to the surface of the brick only an inch. Expansion joints were of ½-in. preformed rubber. Joints were doweled with capped and greased ⅝-in. dowels 2 ft. long, spaced on 12-in. centers. No transverse contraction joints were used.

Longitudinal dummy joints composed of premolded bituminous strips ¼ x 2 in. were set into the concrete by machine 10 ft. from either edge of the finished pavement. This resurfacing job was done with the expectation that ultimately the road would be widened to 40 ft. The crown of the 30-ft. section, therefore, was graduated from 3 in. on one side to ¾ in. on the other.

The work was done by the Indiana State Highway Department of which M. R. Keefe is chief engineer, with Ralph Pinnick, resident engineer, in direct charge. The contractor was the Grace Construction & Supply Co., of Fort Wayne, Ind.

HAND FINISHING *around transverse joints after removal of metal sleeve.*



LONGITUDINAL FLOAT *operated from double bridge finishes pavement surface.*

EDGE OF PAVEMENT *along forms is finished by hand float.*

# 90% OF YOUR TRACTOR WORK IS DONE AT THE HIGHER SPEEDS . . . BUY TRACTORS THAT *Excel* ON THIS 90%

Allis-Chalmers tractors are designed to deliver maximum performance at the higher working speeds. These are the speeds at which you do 90% of your tractor work on the average construction job. Buy tractors for this 90% of your work . . . not for the other 10%.

*ABOVE*—Building spur line for railroad near Canton, Ill. In the foreground are two Model "S-O" Oil Tractors pulling Continental Scrapers on tracks. *BELOW*—Model "S-O" Tractors and 7-yard Continental Scrapers on road building jobs in Illinois and Wisconsin.

# THE GO"—haul more loads per day

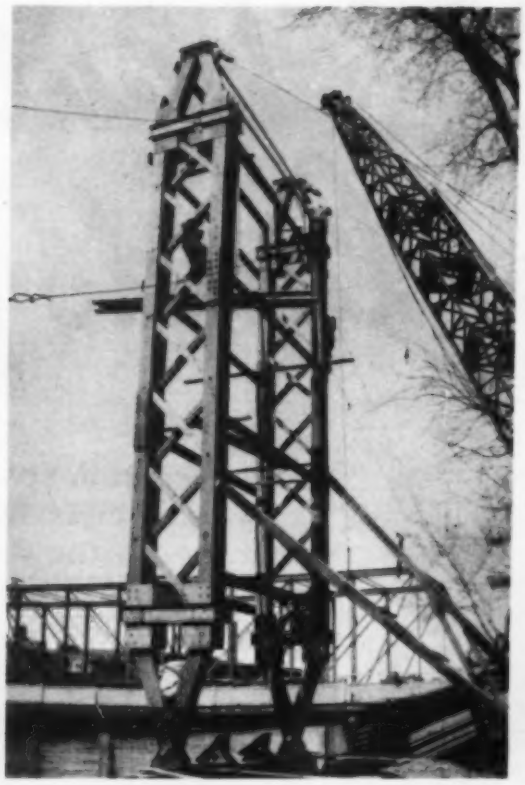
The seconds you save shifting gears with an Allis-Chalmers Model "S-O" . . . count up into minutes in the course of a day. These minutes mean more trips, more yardage, more profit for the Allis-Chalmers owner. With the "S-O", it is not necessary to come to a complete stop to shift gears. You shift "on the go"—like a motor truck. Only the Allis-Chalmers Model "S-O" has this time-saving feature . . . a Constant Mesh Transmission with gears always in mesh. Only the Model "S-O" in its power class (64 drawbar H.P.) has 5 speeds forward—up to 6.37 miles per hour. In its size and price class, only the "S-O" has that famous Allis-Chalmers BALANCE . . . which means quicker pick-up, higher working speeds, better hill-climbing, greater economy, less maintenance and superior all-'round performance. Only the "S-O" is built to BEAT the job—not stretched to meet it. Put the "S-O" to work on your job! It's the MODERN tractor for modern requirements. Ask the A-C Dealer!

**TRACTOR WEIGHT SAVED MEANS EXTRA PAYLOAD GAINED**

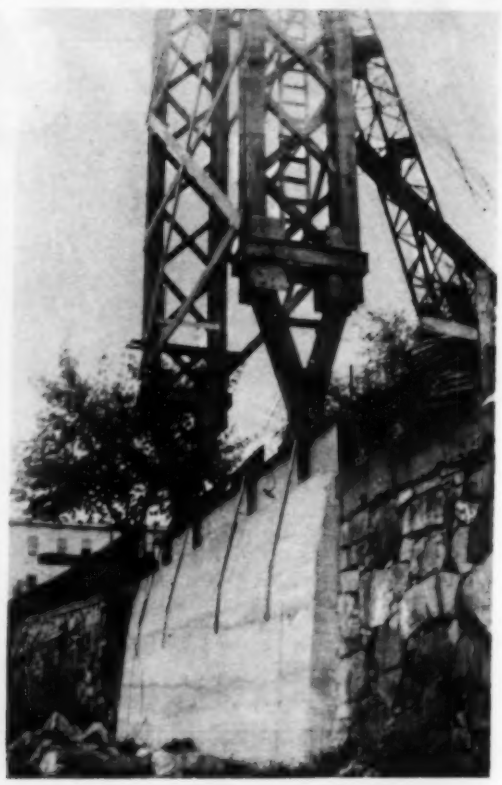
**ALLIS-CHALMERS**
TRACTOR DIVISION—MILWAUKEE, U. S. A.

*Controlled Ignition* **OIL TRACTORS.**
*Timed Right to Fire at the Right Time*

**TOWER LEGS** *of Oregon fir, framed with bolts and split-ring connectors at joints, are raised to vertical position by locomotive crane.*



**EACH TIMBER TOWER** *is 55 ft. high, with legs spaced 30 ft. apart. V-shaped base rests on pin connection carried by steel I-beam grillage.*

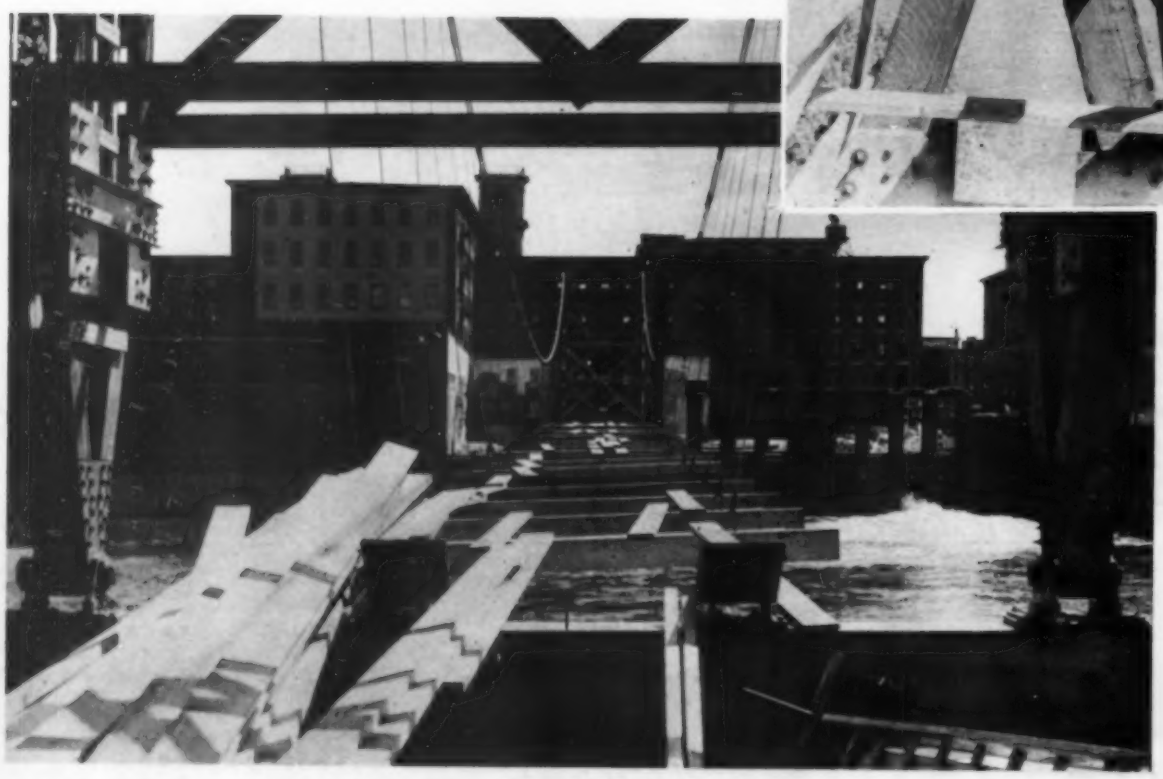


**CONCRETE REINFORCEMENT** *of old masonry wall along river was necessary to carry weight of towers supporting bridge cables.*

# Suspension Cables

## Carry Walkway Bridge

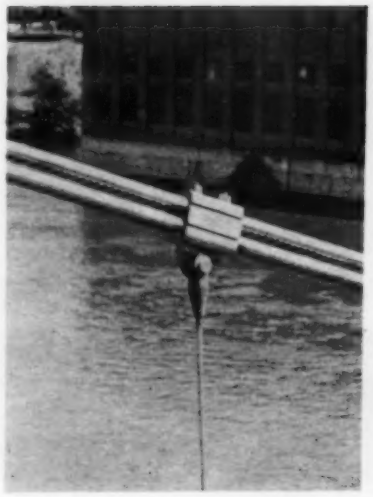
**SADDLE** *(left) carries suspension cables over tops of 55-ft. timber towers. Note backstay cable connection below and at left of saddle.*



**SUSPENDER CABLES** *support beams for walkway of bridge.*

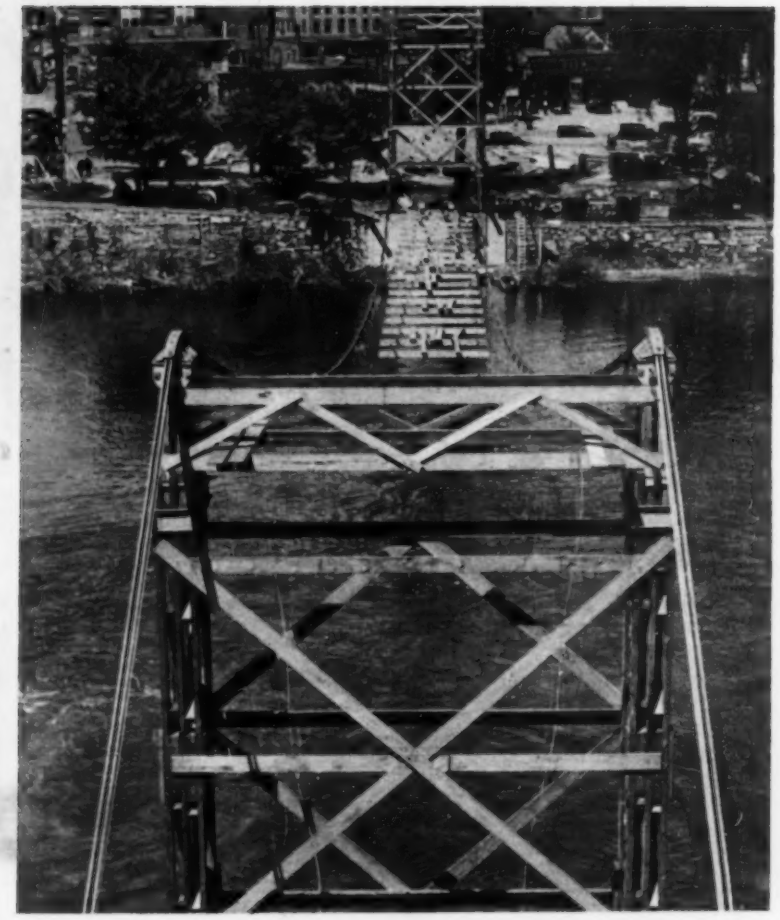
TO ACCOMMODATE PEDESTRIANS only, during reconstruction of a nearby bridge damaged by the severe floods that swept over New England last year, a cable suspension bridge with a main span of 475 ft., supported by timber frame towers and carrying a walkway 6 ft. wide, has been erected across the Merrimac River at Lowell, Mass. The structure is a temporary one and will be removed when the permanent river crossing at Bridge St. is completed and placed in service.

Designed by J. R. Worcester & Co., consulting engineers, and erected by Coleman Bros. Corp, contractor, both of Boston, the temporary walkway suspension bridge employs the



CLAMPS *on main cables provide connection with vertical suspender cables supporting walkway of bridge.*

ANCHORAGE *consists of steel plates concreted into 20-ft. holes in ledge rock.*



MAIN SUSPENSION SPAN *is 475 ft. between framed timber towers 55 ft. high.*

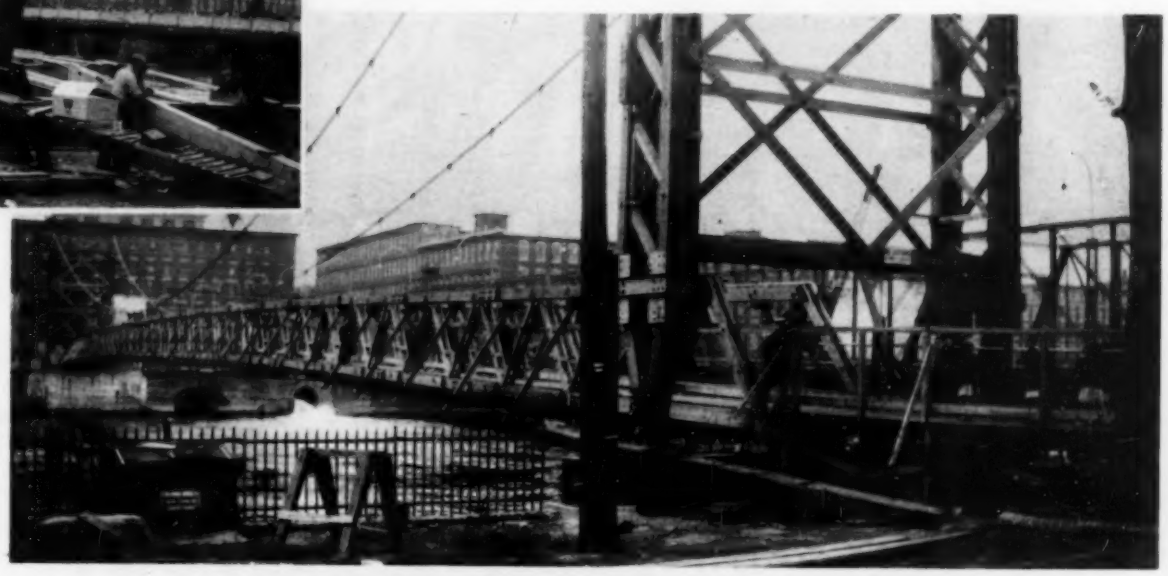
FABRICATING WOOD TRUSSES *to carry walkway of suspension bridge across Merrimac River.*

ATTACHING FLOOR BEAMS *to hanger cables to support walkway.*

open type of cable construction, with two main cables each consisting of a group of four 1⅜-in. diameter Roebling galvanized steel, prestressed bridge strands. The cables are carried by two wood towers 55 ft. high, built of stock sizes of Oregon fir framed with bolts and split-ring connectors to insure strong, rigid joints. Each tower has two legs, measuring 6 ft. wide and 2 ft. thick, spaced 30 ft. apart, tied together by cross-bracing and strengthened by steel angles and plates. Each tower leg, tapering to a V at its base, as illustrated in one of the photographs, is pin-connected to a steel casting mounted upon an I-beam grillage. Curved saddles at the top of each tower carry the main suspension cables. After they had been framed on the ground the tower legs were raised to place by a locomotive crane and guyed.

In each of the backstays for the towers there is one additional 1⅜-in.-diameter strand attached to the tower top just below the main saddle. This is necessary because of the difference in angularity between the cables in the main span and those in the side spans. Anchorage for the suspension cables is provided by bars set in concrete in holes 20 ft. deep in ledge rock.

The walkway of the bridge, 6 ft. wide, is carried by floor beams between wood trusses supported by suspender cables from the main cables.

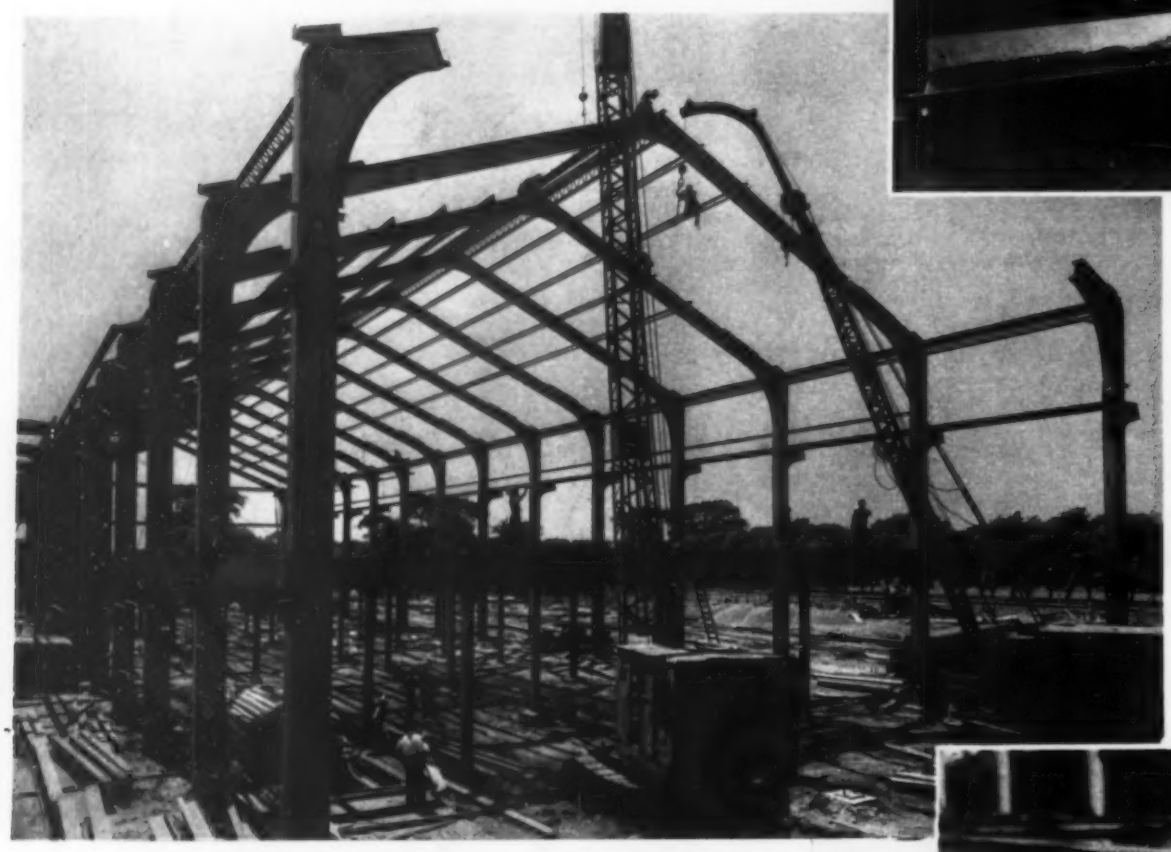


COMPLETED BRIDGE *with wood trusses flanking 6-ft. walkway for pedestrians.*

*All-Welded Rigid Frame Factory Has*

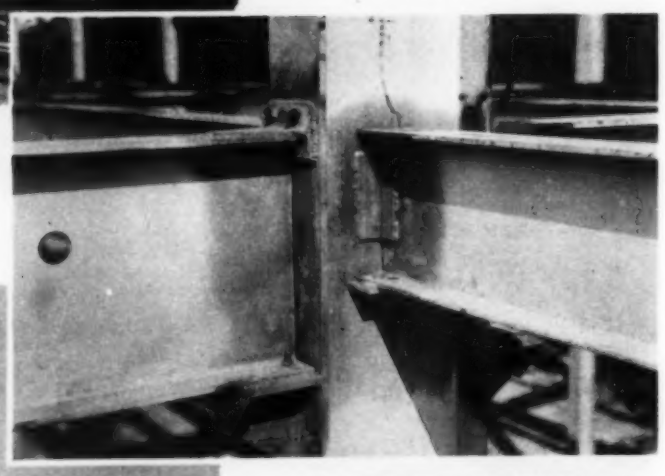
# "Tree-Form" Columns

TREE-FORM COLUMNS *for structural steel frame of factory addition are shop-fabricated by electric welding. Project involving 1,314 tons of steel required 29,600 lin.ft. of welding, of which 25,000 ft. were made in shop and 4,600 ft. in field.*

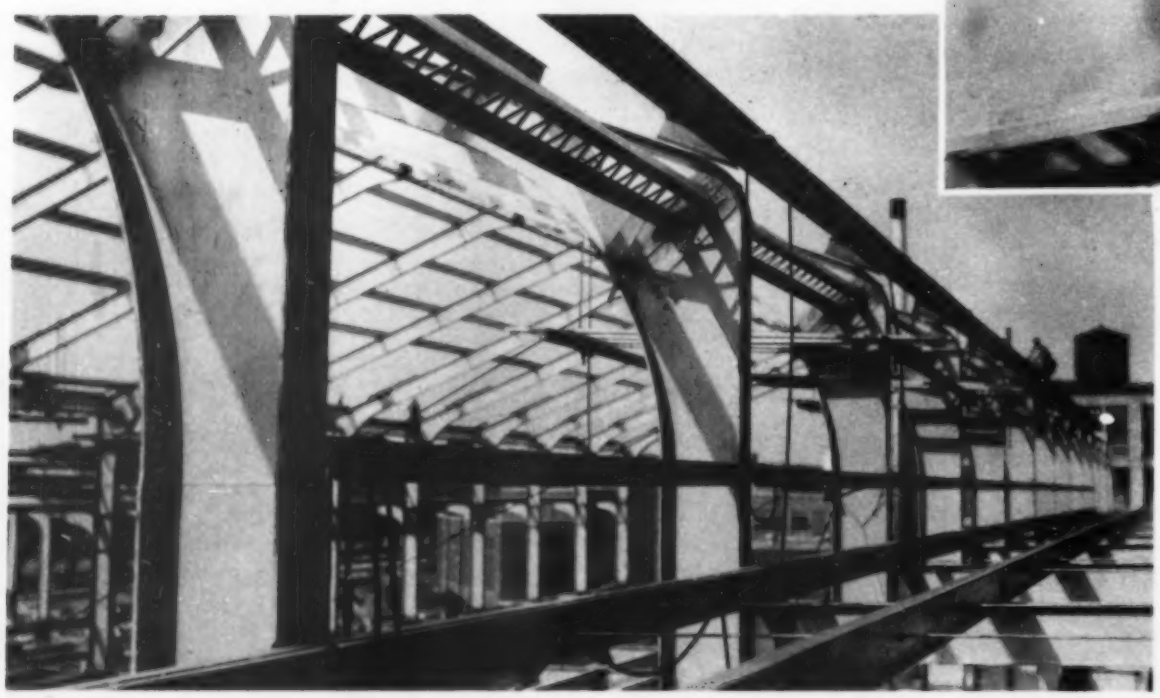


STEEL ERECTION *was handled by a pair of crawler-mounted gooseneck cranes with long booms. In this view cranes are setting 65-ft.-long roof girders for connection with tree-form columns in factory bay 80 ft. wide*

ELECTRICALLY WELDED "tree-form" columns, recently developed by The Austin Co., industrial engineers and builders, are a structural feature of the 200,000-sq.ft. factory addition, involving 1,314 tons of steel, erected in four weeks for the Lincoln Electric Co. at Cleveland, Ohio. The new two-story



SECOND FLOOR FRAMING DETAIL *at main column. Floor beams and girders rest on seats electrically welded to columns during shop fabrication by arc welding.*



RIGID FRAME DESIGN *for bay 240 ft. long involves tree-form columns with electrically welded connections to roof girders. Major part of welding was done by shielded-arc process in shop prior to erection in field.*

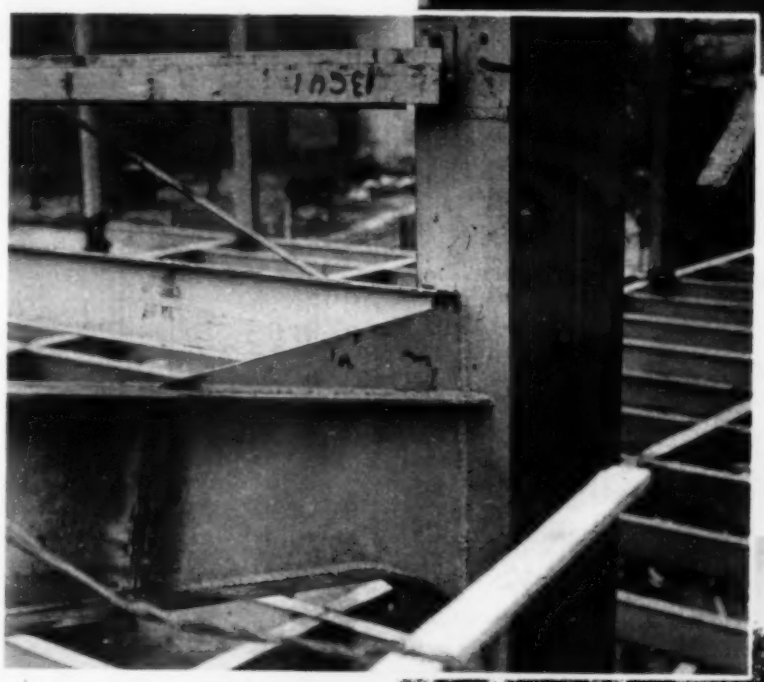
structure, of welded rigid frame sawtooth design, is a modern example of the silent building art recognized recently in New York City's new building code which permits use of welding in building construction. With modern exterior distinguished by continuous horizontal runs of glass block and sash, the factory addition will obtain 100 per cent availability of space from floor to roof by elimination of all cross members and trusses. The design assures light of maximum intensity and uniformity.

The welded tree-form column sections, the principal feature of the design, were entirely plate fabricated by arc welding. The components, cut and rolled to proper size and shape, were placed in jigs, clamped, tack-welded, then finish-welded into one integral section. The "tree-form" sections, welded to standard H-beams in the shop, provided the main and stud columns of the building.

The saw-tooth section, with aisles ranging from 240 to 442 ft. in length, is the first in which such extensive areas have been opened up for free flowing production through every cubic foot from working floor to rafters. It occupies the largest portion of the second floor.

The same rigid frame construction

**"CATHEDRAL" BAY** *with 80-ft. clear span and 240-ft. length provides well-lighted unobstructed floor space for factory operations. Building with continuous horizontal runs of glass block and sash, has cement tile roof.*



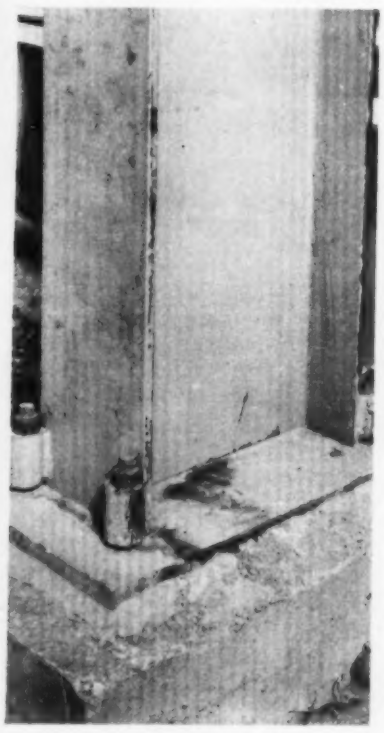
**ARC-WELDED JOINT** *connects roof member of rigid saw tooth frame to main column of steel frame structure.*

characterizes a lofty bay 240 ft. long, 80 ft. wide and 39 ft. high, also situated on the second floor. Tree-form columns, each weighing 2 tons, support simple 65-ft. welded rafters which completely span this bay. These rafters, welded to the columns, support a cement tile roof.

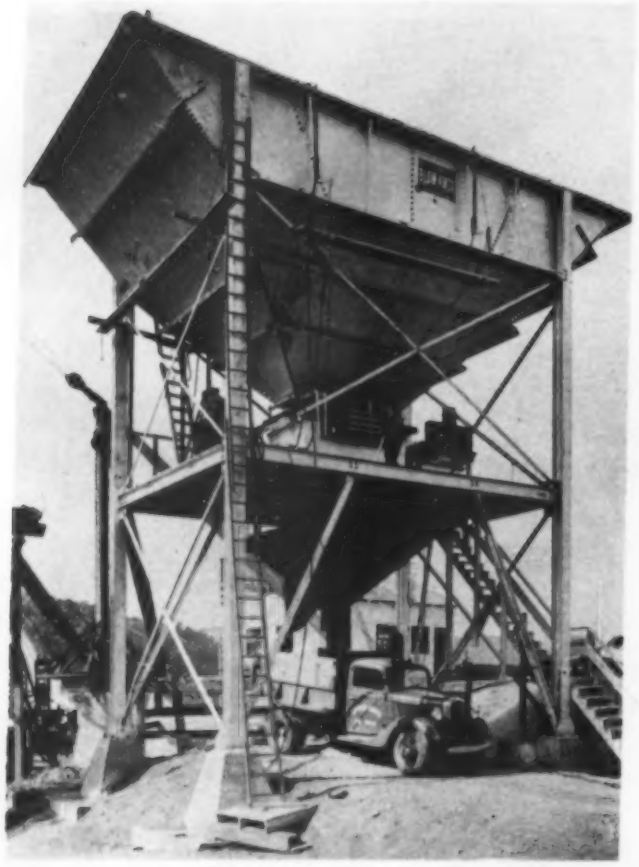
The speed of field erection for welding is indicated by the fact that 93 tons of steel were erected in one 8-hr. day. Using two crawler-mounted goose-neck cranes with long booms, erection of the 1,314 tons of steel was begun July 7 and approximately 1,300 tons were in place by Aug. 2. The accuracy of shop fabrication by welding is indicated by the ease of erection. Shop welded members, consisting of columns, 65-ft. rafters, intermediate rafters, floor beams, girders, lattice frames, roof purlins, etc., lined up perfectly for the temporary bolted field connections. Erection and welding costs per ton of steel for this building were lowered by efficient design and experience gained in erecting structural steel by welding. A total of 29,600 lin.ft. of welding using more than 5½ tons of welding electrode were required. Of this welding footage, 25,000 ft. have been in fabrication of the steel at The Austin Company's Cleveland structural shops and 4,600 ft. in erection. All the welding was done by the shielded-arc process with heavily coated electrodes.

The new Lincoln building, embodying improved technique of welding both in shop and field is being erected to meet increasing demands for welding materials and equipment stimulated by growing application of the art in all types of metal fabrication. The Lincoln Electric Company manufactures Fleetweld arc welding electrodes and Shield-Arc welding generators, both of which were used in construction of the plant.

**ROOF GIRDER SECTIONS** *65 ft. long, lying on floor beams, are joined by field weld, prior to being hoisted by long-boom cranes into position for connections with tree-form columns.*



**COLUMNS** *(right) are anchored to base plates by four heavy bolts, one end embedded in concrete pier and other passing through piece of electrically welded tubing.*



## BIG BATCHER

*and truck-mixer loading plant is installed by McCrady-Rogers Co., of Pittsburgh, to meet increased demand for mixed concrete. Aggregate bin of Blaw-Knox unit has capacity of 300 tons and is divided into four compartments-in-line. Batching plant has 4-cu.yd., four-material weighing batcher with four-beam scale. Future plans call for installation of complete bulk cement plant.*

## SHEEPSFOOT TAMPING ROLLER

*used by Brown & Root, Inc. of Austin, Tex., compacts earth fill in north dike of Buchanan dam, being built by Lower Colorado River Authority near Burnet, Tex., as described in August, 1937, issue, pp. 42-46.*

# How They Did It—

## CONSTRUCTION DETAILS FOR

# Superintendents and Foremen

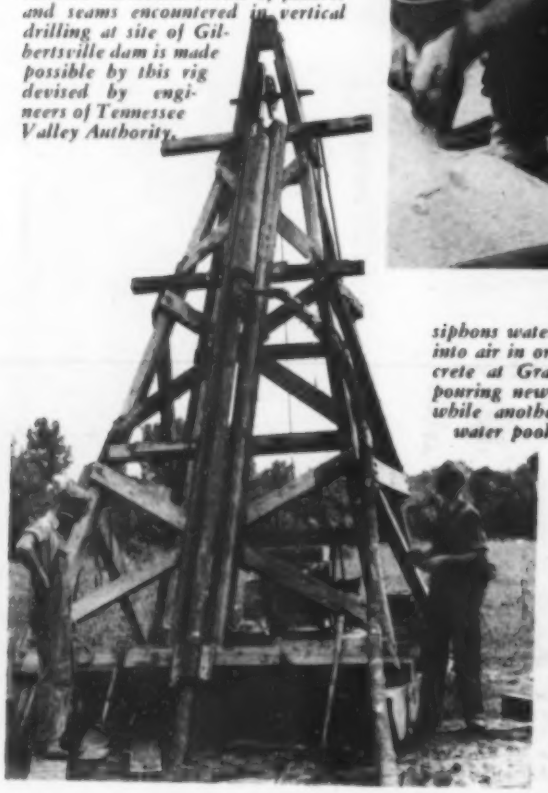
## DUAL PURPOSE

*(below) is served by Douglas fir plywood panels in residential construction at Steilacoom Lake, Wash. After being used as concrete forms for foundation and basement walls of structure the panels are stripped and re-used as subflooring.*



## ANGLE DRILLING

*(below) into bedrock to determine relative horizontal extent of fissures and seams encountered in vertical drilling at site of Gilbertsville dam is made possible by this rig devised by engineers of Tennessee Valley Authority.*



## AIR-JET

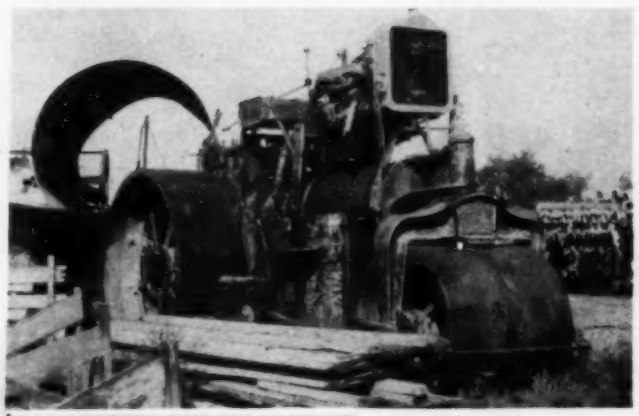
*siphons water from pools and sprays it into air in order to dry surface of concrete at Grand Coulee dam prior to pouring new lift. One man directs jet while another holds suction hose in water pool on surface of concrete.*

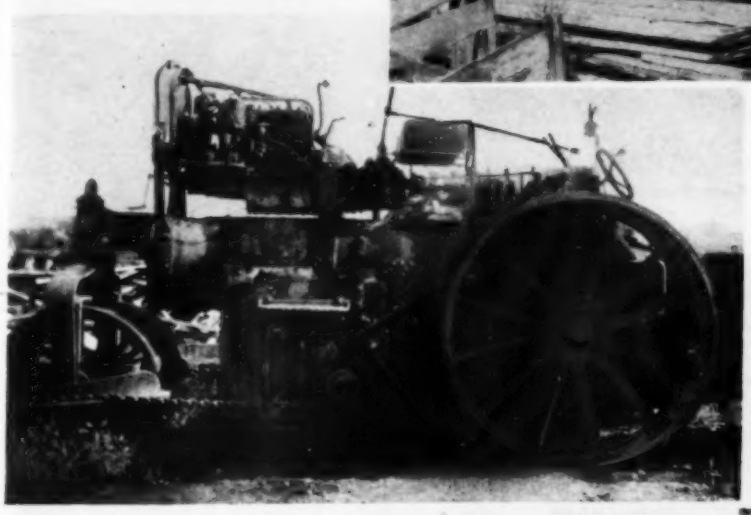
## COTTON MATS

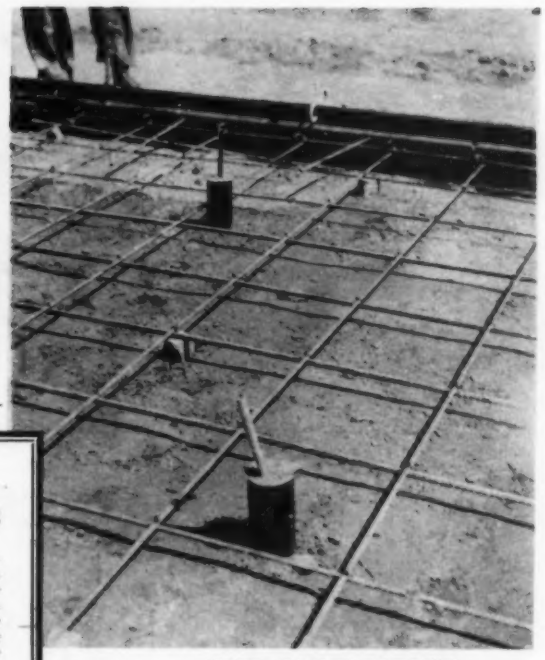
*(below) in sizes of 6x22 ft. and 6x12½ ft. prove effective, when wet, in curing concrete pavement on highway relocation by Parker-Schram Construction Co. in Portland, Ore. For test purposes mats are supplied free by U. S. Bureau of Public Roads.*

## FROM STEAM TO GAS

*(Below and right) Here is how M. E. Carlson Construction Co., of Denver, Colo., modernized an old Kelly-Springfield road roller by converting it from steam-powered into gasoline-powered machine. "We took the old machinery off the top," reports Mr. Carlson, "and installed a White "40" Motor. We find the modernized roller very economical and it certainly does the work. The change increased the speed to approximately 4 mi. per hour and the roller is standing up in wonderful shape, even at the increased operating speed."*







## MUD JACK HOLES

*are cast in concrete paving expected to settle somewhat on fill between bulkheads of causeway in Jackson County, Miss. Holes are formed by placing cans filled with sand on subgrade prior to pouring concrete slab. Scheme will save drilling completed slab to introduce grout for leveling pavement where it may settle with fill.*

**WANTED —**
**Photos of Details**

The Editor of CONSTRUCTION Methods and Equipment wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

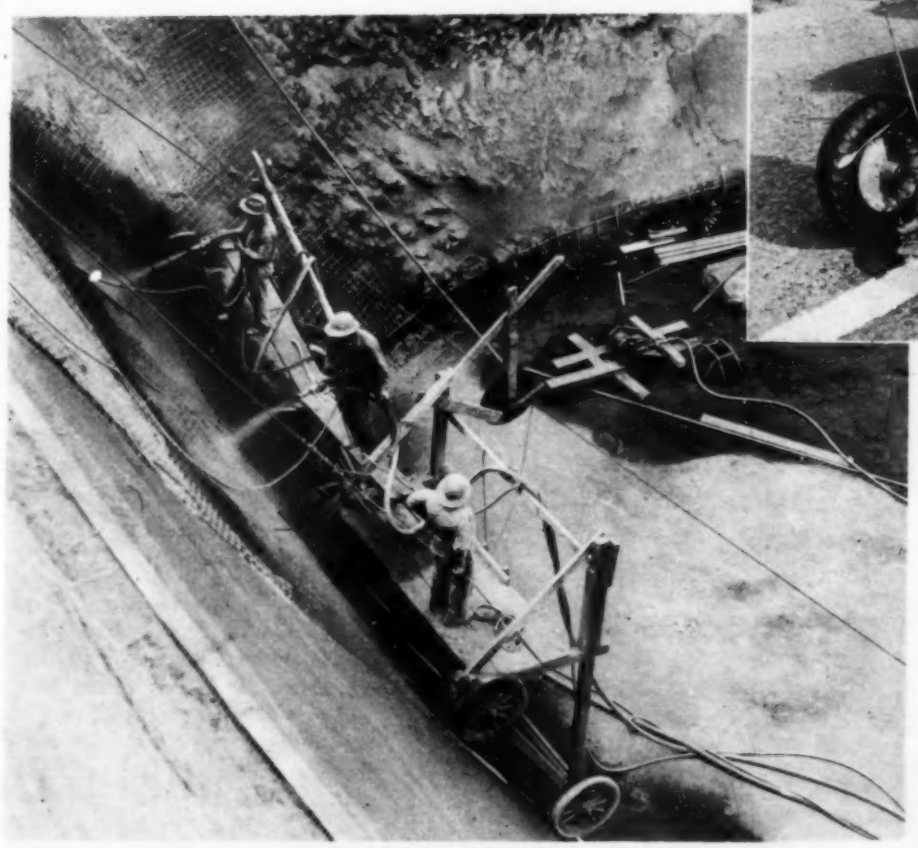
Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

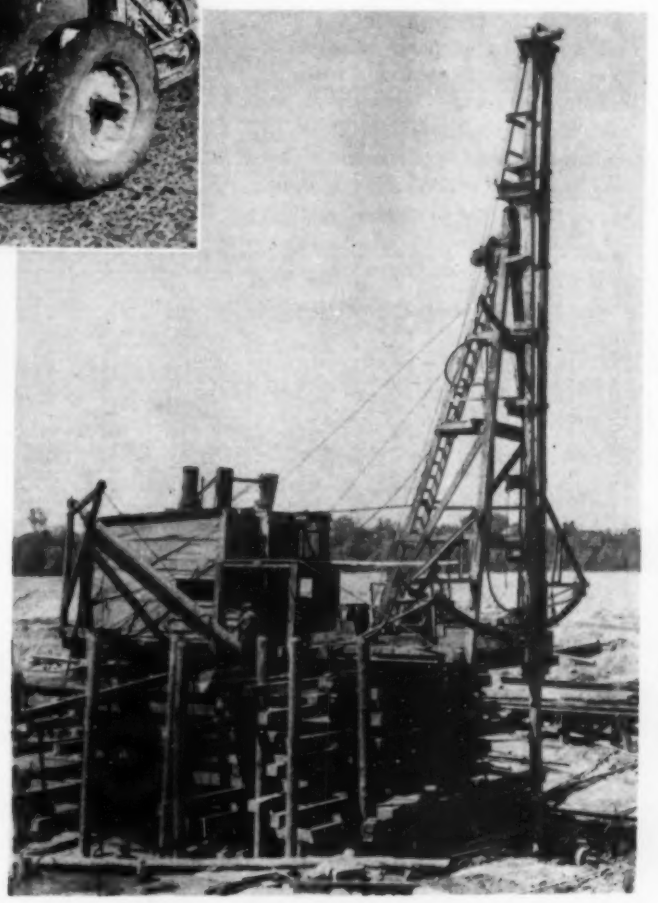
## HOMEMADE TRAFFIC STRIPER

*(right) for applying paint to road surface by means of air pressure, is made of four old ice-cream cans with open ends welded together, rubber-tired wheels (containing no air) from old wheelbarrows, and mail-order spark-plug air pump, operated by motor-truck. Pump produces air pressure of 40 lb. per square inch in horizontal tank. Paint is carried in vertical tank where air pressure of 10 lb. per square inch is maintained by reducing valve. — Photo from* S. L. CARPENTER, *Luray, Va.*

## PILE DRIVER

*(below) for both vertical and batter piles at Mississippi River Lock No. 3, Red Wing, Minn., has leads pivoted at top of A-frame and also at lower and upper swing tracks. Leads tilted into position by cable running over pulley at end of lower swing track to small swing engine. Old truck tire forms cushion for pulley at Hammer line at top of ladder on A-frame. Rig can drive piles at batter of 20 deg. on either side.*





## SPECIAL SCAFFOLD

*equipped with old rubber-tired automobile wheels on inverted A-frame and hung by cable from pulley at top of 100-ft. slope, proves useful in applying Gunite coat to surface of 3,000,000-gal. reservoir being constructed by WPA labor under direction of U. S. Army Engineers for 1939 Golden Gate International Exposition at San Francisco. Rig operated by winch on reservoir bottom was devised by John S. MacDougal, associate engineer on project.*

*Planning and Plant for*

TWENTY-THIRD OF A SERIES OF ARTICLES

# HEAVY CONSTRUCTION

## Principles and Practices of Job Layout and Selection and Use of Equipment

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER
*Construction Engineer* *Construction Consultant*

**• 23 •**
**Concrete Placing and Forms**

IT IS BETTER to overplant than to underplant. This principle deserves the most careful consideration when it comes to laying out the placing equipment for a large dam project. The placing system is usually the main feature of a plant layout, and if it is designed adequately to meet the "natural rate of construction" or the schedule as set up by other requirements, the other related plant units can readily be designed to accommodate the demands of the placing plant.

The placing plant is usually the most expensive element and there is, therefore, a natural tendency to restrict the expenditures for it or to economize wherever possible. This may lead to wide divergence of opinion as to the best method of doing a job, as was effectively illustrated in Chapter 1 (see issue of November, 1935). Every constructor who has laid out a plant for a large project will recall that, except in a few cases, he has been obliged later to add an extra derrick or one or two cranes or some other auxiliary equipment to meet unforeseen demands. It is difficult to visualize all of the operations for several years ahead on a large dam-building project. If the plant is designed to meet most of these operations without allowing for a so-called "factor of ignorance," certain times are bound to occur when additional capacity would be very useful either to make up for lost time or to take advantage of unforeseen breaks which, if they can be utilized, mean an extra profit.

WHIRLER CRANE *handling 4-yd. buckets of concrete at Pickwick Landing dam.*

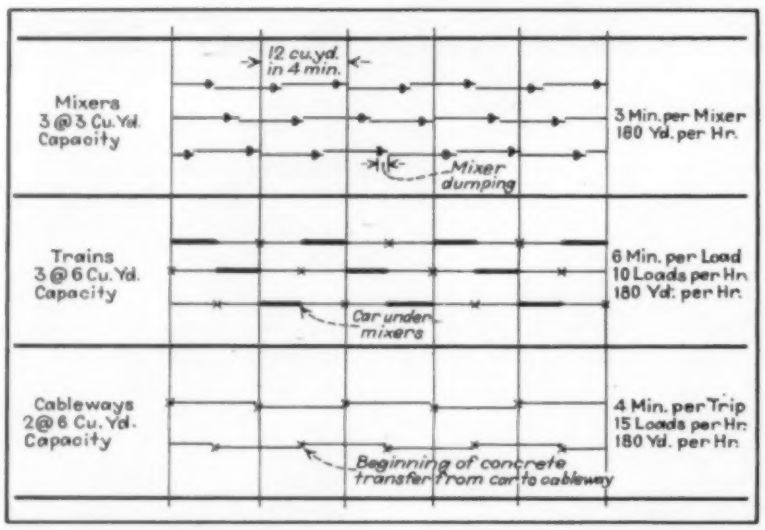

12 cu.yd. in 4 min.
Mixers 3 @ 3 Cu.Yd. Capacity
3 Min. per Mixer 180 Yd. per Hr.
Mixer dumping
Trains 3 @ 6 Cu.Yd. Capacity
6 Min. per Load 10 Loads per Hr. 180 Yd. per Hr.
Car under mixers
Cableways 2 @ 6 Cu.Yd. Capacity
4 Min. per Trip 15 Loads per Hr. 180 Yd. per Hr.
Beginning of concrete transfer from car to cableway

**Fig. 1 . . . TIME CYCLES** *shown in operating diagram for concrete mixing, transferring and placing plant at Norris Dam.*

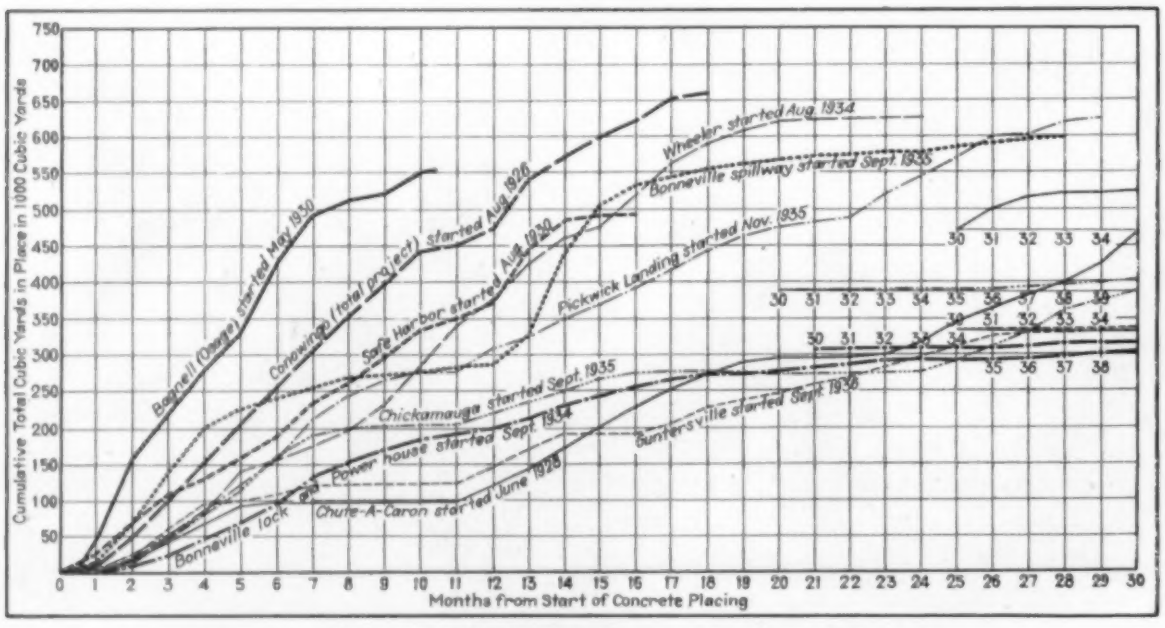
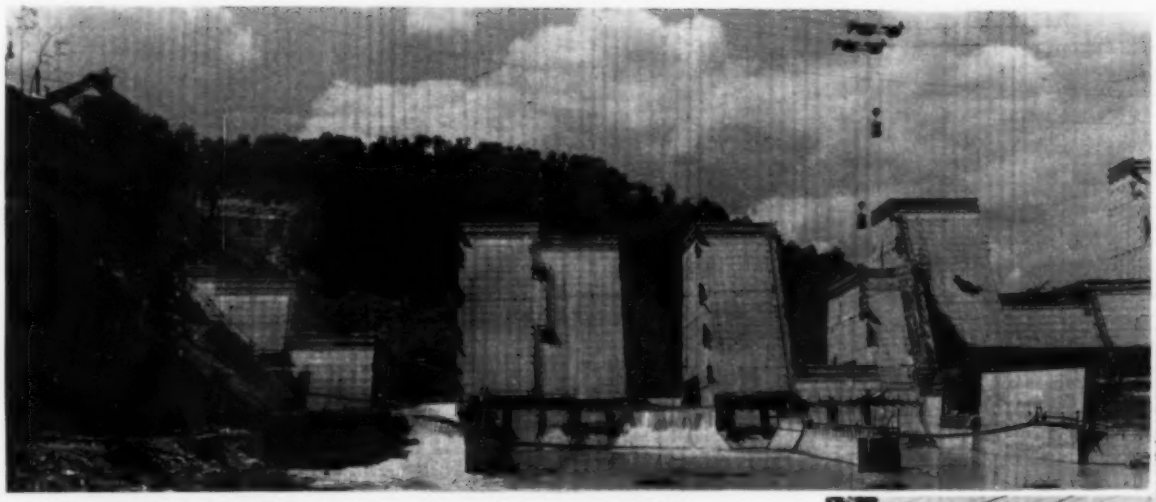

Cumulative Total Cubic Yards in Place in 1000 Cubic Yards
Months from Start of Concrete Placing
Bonneville lock and power house started Sept. 1934
Chute-A-Caron started June 1928
Bonneville spillway started Sept. 1935
Wheeler started Aug. 1934
Conowingo (total project) started Aug. 1926
Boswell (Osage) started May 1930
Safe Harbor started Aug. 1930
Pickwick Landing started Nov. 1935
Chickamauga started Sept. 1935
Guntersville started Sept. 1936

**Fig. 2 . . . RATE OF CONCRETE PLACEMENT** *for various wide river dams.*

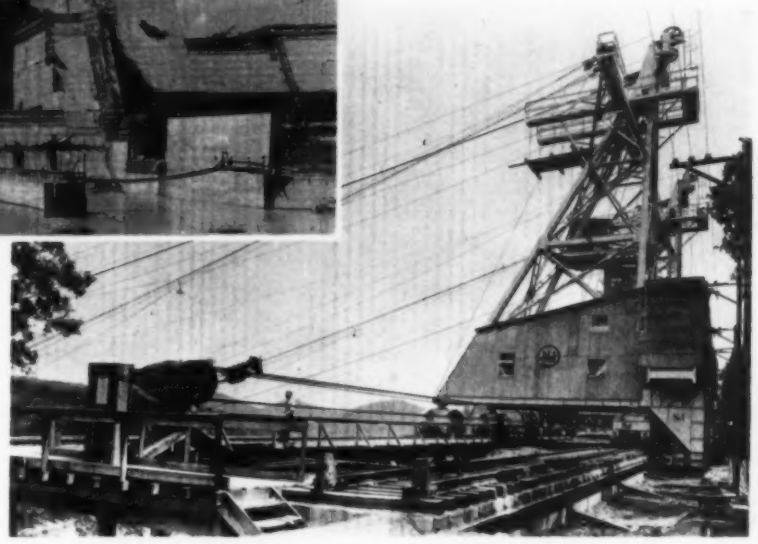
Some of the principles with respect to general plant layout have been discussed in Chapter 4 (see issue of March, 1937). Furthermore, the mixing, transferring and placing of concrete are so closely interrelated that it is necessary to analyze these various operations as one in making a layout. The problem of designing the proper capacity in a mixing plant was discussed in Chapter 22, last month, and a table of output experiences from various large projects was presented there. The significant point, which is here repeated, is that the maximum possible output of a plant for one day has very little importance, and while a record-breaking performance is usually widely acclaimed, it should be kept in mind that it is the average *continuous performance* over a long period of time which defines the efficiency of a plant and organization, and which also limits the profit in a job.

Figs. 2 and 3 represent a collection of curves showing the rate of placing concrete on most of the large projects built during the last 10 years. The average slope of each line represents the rate of placing concrete over long periods, and while in almost every case there are some rather steep slopes in the curves, which indicate the actual ability of the plant, it is the flatter overall slopes which define overall performance. These flatter slopes mean that other circumstances, such as handling of the river, building cofferdams, winter weather, limitations in the permissible rate of raising concrete, or other factors, had a controlling effect. In some cases the plant itself was a limiting factor, due to the necessity of making revisions in lay-



**OVERHEAD CABLEWAYS** *deliver concrete at Norris Dam providing maximum freedom for handling river during construction.*

**HEAVY-DUTY CABLEWAYS** *(below) at Norris dam are capable of handling 25 tons each. Note fully equalized wheels and horizontal thrust wheels for lateral pressure.*



out during the course of a job, such as relocating the placing or delivery equipment and similar changes.

After the average rate of placing and the duration of the job have been established in terms of maximum economy, taking account of all related factors, a theoretical capacity must be established to serve as an output figure for which all interrelated plant units are designed. We are then ready to discuss output and capacity in terms of individual cycles. A convenient way to analyze plant requirements in terms of such cycles is to set up diagrams similar to the one shown in Fig. 1. This shows the cycle performance for the mixers in the mixing plant, the transfer cars and the cableways at Norris dam. By timing each unit for its maximum output and efficiency and properly interrelating these, the job is so locked together that all parts of the plant will function efficiently whenever conditions permit operation of the placing equipment at its maximum output. In some cases it is necessary to consider longer distance of travel for transfer cars and other equipment, and the proper selection of speed, capacity and number of units may necessitate four or five such diagrams before the most efficient combination becomes apparent.

### Placing of Concrete

The most commonly accepted modern machines for concrete placing are derricks, whirler cranes traveling on track runways or special elevated trestles, cableways, belt conveyors, special gantry or hammer-head cranes, and Pumpcrete machines, as described in the previous chapter. Derricks were used extensively at one time, but their slower swing and fixed setting has led to a more extensive use of whirler cranes. Such cranes in many cases have almost as long a boom as a standard derrick, and for certain special cases their reach can be extended further than normal by the use of light-weight aluminum booms. In addition, they have a fast swing and can be propelled on tracks to cover a considerable area. Traveling whirlers should be equipped with self-propelling direct gear drives.

Hoisting equipment is gradually and definitely improving. Rope speeds have been increased, the drums hold more cable, steel cut teeth have largely displaced cast-iron gearing, the gears are guarded more effectively, and asbestos fabric-type brake linings have largely displaced wooden blocks. Air-control levers or electric controls are rapidly displacing the more cumbersome and slower mechanical levers. Double-cylinder steam hoists have become generally standardized, as listed in the accompanying table.

DOUBLE CYLINDER STEAM HOISTS

| *Size of Steam Engine, In.* | *Bhp.* | *Max. Line Pull Lb.* | *Line Speed Ft. Per Min.* |
|---|---|---|---|
| 7 x 10 | 23 | 7,000 | 175 |
| 8¼ x 10 | 30 | 8,500 | 175 |
| 9 x 10 | 44 | 10,000 | 175 |
| 10 x 12 | 58 | 13,000 | 175 |
| 12 x 12 | 65 | 16,000 | 175 |

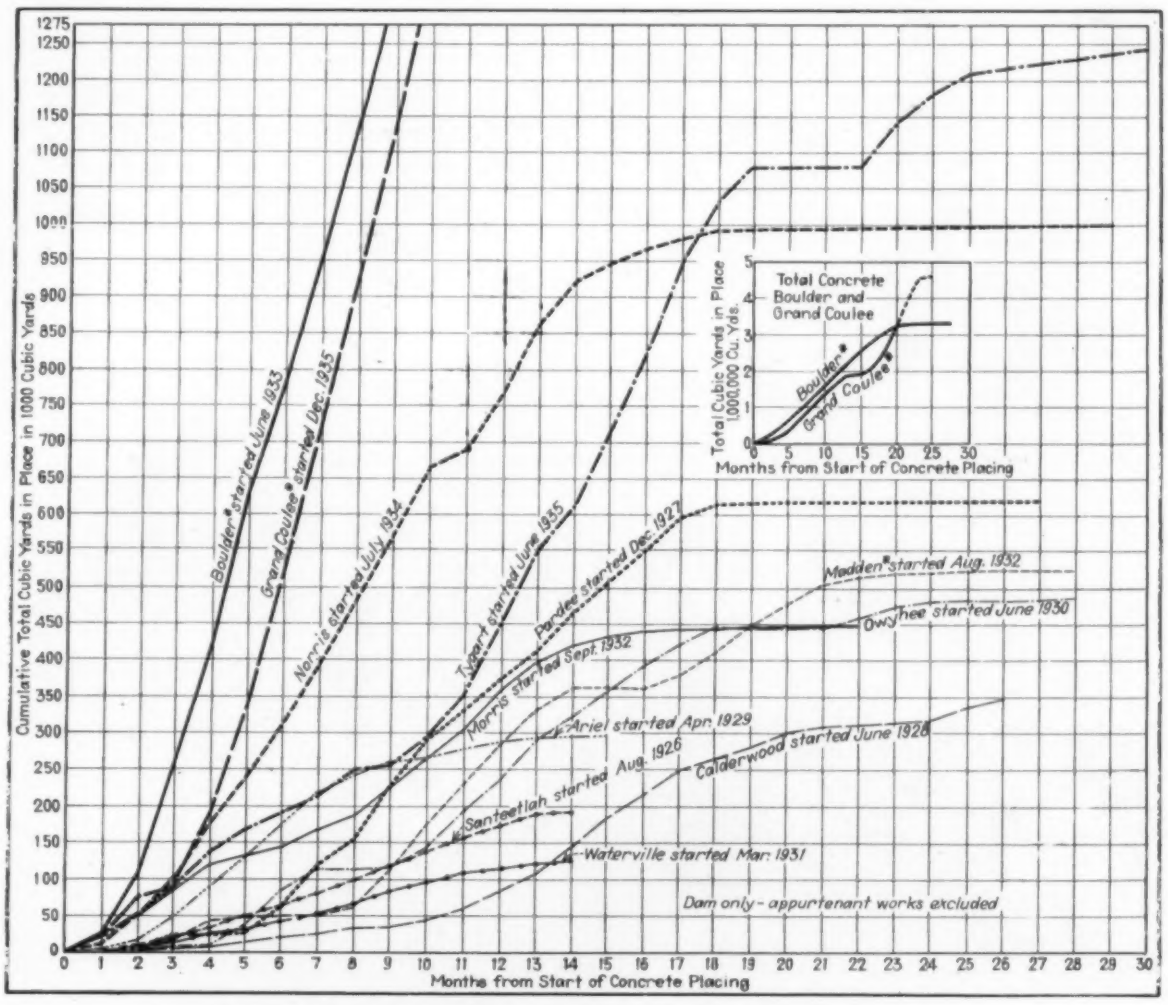

Cumulative Total Cubic Yards in Place in 1000 Cubic Yards
Months from Start of Concrete Placing
Boulder* started June 1933
Grand Coulee* started Dec. 1935
Norris started July 1934
Tygart started June 1935
Pardee started Dec. 1927
Madden* started Aug. 1932
Owyhee started June 1930
Morris started Sept. 1932
Ariel started Apr. 1929
Calderwood started June 1928
Santeetlah started Aug. 1926
Waterville started Mar. 1931
Dam only - appurtenant works excluded
Total Concrete Boulder and Grand Coulee
Total Cubic Yards in Place 1,000,000 Cu. Yds.
Months from Start of Concrete Placing

**Fig. 3 . . . RATE OF CONCRETE PLACEMENT** *for various canyon-type dams.*

While these are conventional horsepower ratings, the power plant furnished is generally capable of as much as 75 per cent more than the rated horsepower. By changing gear ratios and reducing the line pull the drum speeds may be increased proportionately to 200 or up to 500 ft. per minute.

Electric hoists of similar capacities are also available, and in the heavy duty field they run up to 80, 100, and 125-hp. capacities and from there on into extra large sizes up to 400 and 500 hp. Standard hoists providing two-line speeds are also available through a large range of sizes. The speed, power and safety of hoisting equipment has been constantly improved through experience gained on construction work.

In recent years the use of cableways has rapidly increased on large projects, especially after the development of special cables up to 3 in. in diameter of the smooth surface locked coil type, and with the adoption of improved designs of cableway towers of the traveling type in place of timber towers, which had serious limitations as to structural loading as well as in the arrangement of wheels. Steel towers are almost considered standard now for large projects. The 25-ton cableway used on Owyhee dam was the forerunner of the modern heavy-duty cableway, the first of which was used at Madden dam, where structural steel towers 100 ft. high, running on fully equalized wheels, were spaced 1,300 ft. apart and carried a 3-in.-diameter track cable and heavy-duty hoisting equipment capable of handling loads up to 25 tons. Since then similar units of greater span have been employed at Boulder, Norris, Hiwassee, Marshall Ford, Bonneville and Parker dams.

The chief advantage of cableways is their universal adaptability to all kinds of service in addition to concrete handling, such as the delivery directly from a point of unloading to the desired spot of reinforcing steel, pipe, penstocks, gate machinery and the large number of miscellaneous

## Concrete Mixing and Placing Systems

ON LARGE DAM PROJECTS

CANYON TYPE

| PROJECT | QUANTITY CONCRETE | AGGREGATES | | | MIXING EQUIPMENT | TRANSFER EQUIPMENT | PLACING EQUIPMENT |
|---|---|---|---|---|---|---|---|
| Year Completed | Cubic Yards | Type | Source | Transported | No. Type | No. Type | No. Type |
| **BOULDER** Nevada-Arizona (1936) | 4,400,000 | Natural sand and gravel | Pit Deposit (7 mi. to screens and 4.7 mi. more to mixers) | To screens: 4 trains, 90-ton steam loco. & 7-10-& 30-yd. cars. To mixers: By R. R. in 50-ton hopper cars | 2 Complete plants, each with 4 4-cu. yd. mixers Single material automatic weighing batchers: 4 cement; 2 water; 1 for each aggregate size | 5 18-ton electric locomotives<br>5 30-ton diesel locomotives Flat cars carrying 2 buckets, space for 4;-<br>4,000-ft. haul<br>1 Stiffleg derrick, 136-ft. boom | 5 25-ton cableways<br>2 @ 2,575-ft. span<br>2 @ 1,485-ft. span<br>1 @ 1,365-ft. span |
| **GRAND COULEE** (Base Section) Washington (Under Construction) | 4,870,000 | Natural sand and gravel | Glacial deposit (bank pit) 1½ mi. from site | Belt Conveyors 48-in., 5,975 ft. to Storage; 36-in. on 4,600-ft. suspension bridge to west mixer; 36-in. to east mixer | 2 Complete plants, each with 4 4-cu. yd. tilting mixers front end charging and discharging.<br>7 Automatic weighing batchers<br>8 Aggregate bins, aggregate capacity 1,150 cu. yd.; cement capacity 1,350 bbl. | 10 10-ton deisel locomotives<br>10 36-ft. R. R. flat cars, carrying 4 buckets, space for 5; inclined track, carrying 4-cu. yd. skip to R. R. cars on low level trestle. | 2 3,000-ft. steel R. R. trestles<br>7 Hammerhead cranes<br>60 4-cu. yd. buckets |
| **TYGART** Pennsylvania (Under Construction) | 1,166,000 | Natural sand and gravel | Dredged from Ohio River | Railroad to 70-ton bottom-dump cars. 85 mi. to site | 4 3-cu. yd. tilting mixers<br>6 Automatic single material weighing batchers, 4 aggregate, 2 cement | 3 36-in. belt conveyor 10-ton narrow-gage locomotives, each hauling special cars carrying two 3-cu. yd. bottom-dump concrete buckets | 4 Gantry-mounted whirler cranes<br>15 3-cu. yd. bottom-dump buckets |
| **NORRIS** Tennessee (1936) | 990,300 | Crushed sand and rock | Quarry near site | 36-in. and 30-in. belt conveyors to screening and storage and mixing plant | 3 3-cu. yd. tilting mixers<br>1 Set of 8 single material weighing batchers (air controlled); Aggregate bins, capacity, 1,300 tons | 3 8-ton gas-electric locomotives<br>3 6-cu. yd. special 2-skip hopper dump cars | 2 18-ton traveling cableways; span, 1870 ft. Traverse, 475 ft.<br>2 6-cu. yd. special air-dump concrete buckets |
| **PARDEE** California (1929) | 617,700 | Natural river run sand and gravel | Cold dredge spoil bank screened and washed at site | Aerial tramway 18,700 ft. with 1-cu. yd. buckets. Capacity, 120 t. p. h. | 4 3-cu. yd. drum tilting mixers Volumetric aggregate and cement weighing batchers | 1 Chute to base of steel tower<br>1 2-cu. yd. tilting skip buckets hoisted to top of placing tower | 1 Inskey tower and chuting system<br>1 10-ton cableway handling forms etc. Span, 1,380 ft. |
| **MADDEN** Panama (1934) | 550,000 | Natural sand and gravel | River bar pit in Chagres River | Aerial tramway 5,355 ft. with 1-cu. yd. buckets. Capacity, 225 t. p. h. | 3 2-cu. yd. tilting mixers<br>6 aggregate batchers<br>1 cement batcher Aggregate bins, capacity 1,300 tons | 2 8-ton gasoline locomotives<br>2 8-cu. yd. special 2-skip hopper dump cars | 1 25-ton traveling cableway; span, 1,325 ft. Traverse, 410 ft.<br>1 8-cu. yd. concrete bucket |
| **OWYHEE** Oregon (1932) | 550,000 | Natural sand and gravel | Pit deposit | By R. R. 24 mi. to site. 3 steam locomotives and 90 steel hopper cars. Three trains daily. | 2 4-cu. yd. tilting mixers Cumulative weighing batchers | 3 6-ton gasoline locomotives<br>3 special 2-skip center dump cars, capacity 4-cu. yd. per skip | 1 25-ton radial cableway span, 1,306 ft.; Tail tower on 475-ft. radial track<br>8-cu. yd. concrete buckets |
| **MORRIS** (Pine Canyon) California (1931) | 450,000 | Natural sand and gravel | Commercial pit | R. R. 2 mi. Aerial tramway 10,200 ft.; 500-ft. lift; Capacity, 225 t. p. h. | 3 4-cu. yd. tilting mixers Batchers:<br>2 Air-operated, manually-controlled cumulative weighing aggregate<br>2 Weighing cement<br>2 Metered water | 2 48-in., 70-ft., belt conveyors<br>2 small locomotives<br>2 small flat cars each carrying one 4-cu. yd. bucket | 3 10-ton radial cableways with common head tower. Tail towers on radial track; spans 958 and 962 ft.<br>1 20-ton stiffleg derrick Concrete chutes<br>4-cu. yd. bottom-dump buckets |
| **CALDERWOOD** Tennessee (1930) | 346,000 | Crushed sand and rock | Tunnel excavation Foundation excavation Quarry | One 70-ton locomotive and five 30-cu. yd. cars. | 2 Mixing plants, one with<br>1 3-cu. yd. tilting mixer, and one with<br>1 4-cu. yd. tilting mixer Volumetric aggregate batchers; metered water batchers; weighing cement batchers | Locomotive hauling 4-cu. yd. or 2-cu. yd. buckets on flat cars; Maximum haul, 2,000 ft. | 12 20-ton guy derricks with 100-to 125-ft. booms 3-and 4-cu. yd. concrete buckets |
| **DIABLO** Washington (1930) | 316,000 | Natural sand and gravel | River bed deposit | Incline R. R. 300-ft. lift, 68 per cent slope, in ballast cars. Standard gage locomotive; 2,000-ft. to site | 4 1-cu. yd. tilting mixers Weighing batchers Mixer storage, 8,000 cu. yd. | Chutes to base of concreting towers | 3 Hinged conveyors, suspended from masts delivered concrete through large hoses to forms; conveyer end positions adjustable by mast and tag lines |
| **ARIEL** Washington (1931) | 300,000 | Natural sand and gravel | River bar at site | Sauerman excavator and belt conveyors | 3 2-cu. yd. tilting mixers Weighing batchers | 6 7-ton gasoline locomotives hauling 1 to 2 flat cars with 2-cu. yd. bottom-dump buckets | 3 Whirler derricks handling 2-cu. yd. bottom-dump buckets<br>4 guy and stiffleg derricks |
| **SANTEETLAH** North Carolina (1927) | 215,000 | Crushed sand and rock | Quarry 4 mi. from site | One 70-ton locomotive and thirty 20-cu. yd. cars. | 2 2-cu. yd. tilting mixers | Locomotives and one car carrying 4 to 6, 2-cu.yd. buckets Maximum haul, 2,300 ft. | 12 20-ton guy derricks with 90-ft. booms 2-cu. yd. buckets |
| **WATERVILLE** North Carolina (1933) | 123,000 | Crushed sand and rock | Tunnel excavation and quarry | R. R. on narrow gage up to 12 mi. Haul length varied with tunnel length. | 2 2-cu. yd. mixers Weighing batchers | 1 Narrow-Gage gasoline locomotive hauling flat car;<br>2 2-cu. yd. bottom-dump concrete buckets | 2 Whirler cranes on skids on temporary bridge |

AIR-DRIVEN VIBRATORS *for compacting concrete.*

PANEL FORMS *at Madden dam are handled by simple method with air tugger hoist and crew of four men.*

## Concrete Mixing and Placing Systems

ON LARGE DAM PROJECTS

WIDE RIVER TYPE

| PROJECT | QUANTITY CONCRETE | AGGREGATES | | | MIXING EQUIPMENT | | TRANSFER EQUIPMENT | | PLACING EQUIPMENT | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year Completed | Cubic Yards | Type | Source | Transported | No. | Type | No. | Type | No. | Type |
| **CONOWINGO** Pennsylvania (1938) | 663,000 | Natural sand and gravel | Commercial production from Chesapeake Bay | Railroad cars gravel hauled 4 mi. to site | 2<br>4<br>2 | Plants and 2 contracts<br>3-cu. yd. tilting mixers<br>3-cu. yd. tilting mixers<br>Batchers:<br>Sand inundators<br>Gravel, cumulative weighing<br>cement weighing | 10 | 8-ton gasoline locomotives<br>2-cu. yd. side-dump hopper buckets<br>Standard-gage 36-ft. flat cars | 2<br>7<br>4<br>3<br>7<br>7 | Steel R. R. trestles full length of dam<br>40-ft. gage traveling gantries, carrying<br>230-ft. wood towers,<br>190-ft. steel towers;<br>Chuting systems<br>Stiffleg derricks |
| **WHEELER** Alabama (1936) | 637,000 | Natural sand and gravel | Dredged from river bottom | Tow boats and barges;<br>Up to 50 mi. to site | 4<br>1<br>1<br>1<br>1<br><br>1<br>1 | Floating Plants, each with<br>90x40x7-ft. steel barge<br>75-ft. boom whirler crane<br>2-cu. yd. tilting mixer<br>set weighing batchers (multiple type)<br>500-bbl. cement silo<br>set aggregate bins | | No intermediate transfer | 6<br><br><br>6 | Traveling whirler cranes with 95-ft. booms; four on 14-ft. gantries; two on low trucks<br>2-cu. yd. bottom-dump buckets |
| **PICKWICK LANDING** Tennessee (Under construction) | 610,000 | Natural sand and gravel | Dredged from river bottom | Tow boats and barges; 5-10 mi. to site. | 3<br>7<br><br><br>7<br><br> | 3-cu. yd. tilting mixers<br>Weighing batchers:<br>5 aggregate, 1 cement, 1 water<br>Mixer Bins:<br>6 Aggregate, total capacity, 750 cu. yd.<br>1 Cement, capacity, 750 bbl. | 1<br><br>3<br><br>1<br>1 | 30-in. belt conveyor flight<br>10-ton gas-electric locomotives<br>12-ton fixed cableway, span ,1,270 ft.<br>5-cu. yd. bottom-dump cableway bucket | 2<br><br>1<br>11 | 6-ton gantry-mounted whirler cranes<br>12-ton gantry-mounted whirler crane<br>2-and 3-cu. yd. bottom-dump concrete buckets |
| **BONNEVILLE** Oregon (Under construction) | 597,000 | Natural sand and gravel | River run pit deposits | R. R. gondola cars; 25-50 mi. to screening plant at site | 4<br>2 | 4-cu. yd. tilting mixers<br>sets single material automatic weighing batchers | 3 | 8-ton gasoline locomotives hauling special 2-skip, 6-cu. yd. capacity hopper cars | 2 | 20-ton radial cableways 223-ft. common fixed tail tower<br>Two 90-ft. traveling head towers on 892-ft. track. Span 2,032-ft.<br>8-cu. yd. bottom-dump buckets. |
| **BAGNELL** Missouri (1931) | 551,000 | Natural sand and gravel | Dredged from river; some sized aggregate purchased | Barge to screens; by steam locomotives and hopper cars to site | 4 | 3-cu. yd. tilting mixers<br>Weighing batchers<br>4,000-cu. yd. live storage | 6 | 8-ton gasoline locomotives hauling one flat car each; four 2-cu. yd. side-dump hoppers on each car | 1<br>3 | Steel trestle full length of dam<br>Traveling electric gantries with 10-ton derricks, and concreting towers with chutes and elevators |
| **CHUTE-A-CARON** Canada (1931) | 524,000 | Natural sand; crushed rock | Sand from glacial deposits; rock from foundation excavation | Sand by R. R. 1 to 5 mi.<br>Rock by R. R. from storage of excavated materials | 2<br>2<br><br>1 | 4-cu. yd. tilting mixers<br>Volumetric aggregate and water batchers<br>cement weighing batcher | 10 | 40-ton steam locomotives, hauling concrete buckets on flat cars, 4 buckets per car | 2<br>54 | stiffleg gantries<br>guy derricks<br>Straight side bottom-dump buckets<br>38, 4-cu. yd. size<br>16, 2-cu. yd. size |
| **SAFE HARBOR** Pennsylvania (1931) | 513,000 | Natural sand; crushed rock | Dredged from Chesapeake Bay; rock quarry 1,000 ft. from site | 20 steam locomotives; hauling bottom cars; sand hauled 50 mi. | 4<br>4<br><br>4<br>4 | 3-cu. yd. mixers<br>Cumulative weighing aggregate batchers<br>Weighing cement<br>Siphon water | 7 | 10-ton gasoline locomotives;<br>Standard flat cars, carrying four 2-cu. yd. side-dump hoppers;<br>1 car per train | 1<br>4 | Steel trestle full-dam length<br>40-ft. gage traveling gantries with 100-ft. steel towers and stiffleg derricks<br>Concrete chutes<br>Derrick Booms: 3 @ 85 ft.<br>1 @ 100-ft. |
| **CHICKAMAUGA** Tennessee (Under construction) | 460,000 | Natural sand; crushed rock | Sand from commercial pit; rock from quarry 1 mi. from site | Sand by R. R. in gondola cars; rock by 30-ton diesel locomotive hauling four 18-cu. yd. cars. | 2<br>1<br><br>1 | 2-cu. yd. tilting mixers<br>Set single material weighing batchers<br>6-compartment aggregate bin | 1 to 3<br><br>3<br>3 | 30-in. belt conveyor flights<br>8-ton gasoline locomotives<br>40-ton flat cars with space for three 2-or 3-cu. yd. concrete buckets | 2<br><br>5<br>5 | 6-ton whirler cranes, gantry-mounted, with 75-ft. booms<br>2-cu. yd. bottom-dump buckets<br>3-cu. yd. bottom-dump buckets |
| **GUNTERSVILLE** Alabama (Under construction) | 310,000 | Natural sand and gravel | Dredged from river bottom | Tow boats and barges; 5-10 mi. to site | 2<br>1<br>1 | 2-cu. yd. non-tilting mixers<br>Set single material weighing batchers<br>6-compartment aggregate bin | 1 to 3<br><br>5 | 30-in. belt conveyor flights<br>10-cu. yd. trucks, carrying two or three 2-cu. yd. buckets | 3<br>12 | 6-ton traveling whirler cranes, gantry-mounted<br>2-cu. yd. bottom-dump buckets |
| **BONNEVILLE** Lock & Power House Oregon (1936) | 240,000 | Natural sand and gravel | Dredged from river. Barge haul 2 mi. to screening plant at Portland,Ore. | Sand material by R. R. in bottom dump hopper cars to aggregate plant at site; haul 40 mi. | 2 | 3-cu. yd. tilting mixers<br>Single material automatic weighing batchers | 3 | 8-ton gasoline locomotives hauling special 2-skip, 8-cu. yd. capacity hopper cars | 2<br><br>2 | 15-ton radial cableways 145-ft. common fixed head tower<br>75-ft. tail towers on 570-ft. track. Span, 1,400-ft.<br>6-cu. yd. bottom-dump buckets |
| **ROCK ISLAND** Washington (1932) | 235,000 | Natural sand and gravel | Pit deposit | 5-cu. yd. trucks; 2 mi. | 4 | 1-cu. yd. tilting mixers<br>Weighing batchers | 4 | 8-ton gasoline locomotives, hauling 1-cu. yd. steel hopper cars 350 ft. to trestle | 1<br>2 | 1,100-ft. steel trestle<br>5-ton gantry cranes with elevator and chuting system |

items that are used in the construction of a dam. This avoids the need for various types of access trackways and special hoisting equipment or other rigging arrangements required where cableways are not available. Furthermore, the resulting complete freedom of handling the diversion of rivers to suit the best and natural conditions of the site permits a greater investment to be absorbed in the cableway installation. Cableways are generally designed to cover the entire construction area and, where feasible, are arranged with the towers at both ends traveling in a parallel direction. In some cases one tower, where it is of unusual height, is fixed, and the tower at the other end is designed to travel on an arc to develop the necessary coverage. The accompanying table gives representative data for modern large cableway installations.

The use of belt conveyors for distribution and placing of concrete on large dams has been attempted several times but with only limited success, and has not received serious consideration on the more recent jobs.

### Dispatching Systems

Of considerable importance in obtaining proper functioning of a large integrated plant is an effective dispatching system. This must be thoroughly studied at the time the plant is designed so that every requirement with respect to dispatching and expected performance is known in advance. If a competent dispatcher is located at some strategic point where he can observe all operations and in special cases or emergencies can signal or telephone instructions to the right point, he can keep the entire system functioning without confusion and loss of time.

As a rule when a large system breaks down at one point or another, it takes considerable time to get all interrelated parts functioning together again in proper tempo and, for this reason, the maintenance of output through effective dispatching is exceedingly important. The dispatching instructions and regulations should be described on charts and issued to all members of the operating organization so their duties are properly understood. Usually numerous special cases develop which cannot be covered by instructions, but if each man knows his job under regular conditions it is easier for him to take care of exceptions.

### Preparations for Placing Concrete

An important element of plant which is frequently considered a mere detail but has considerable bearing on progress, speed, and effective starting of operations at the beginning of a shift is the cleaning equipment for foundations and for completed surfaces of concrete. It is usually necessary to clean off all laitance and impurities before the concrete has set completely, and various types of brushes and high-pressure air and water jets are important accessories in a placing outfit.

### Compaction of Concrete by Vibrators

The use of vibrators for the compaction of concrete has practically reached the status of standard practice. There is little justification for using wet or "sloppy" concrete when the use of vibrators permits thorough compaction and the development of uniform surfaces with superior concrete in which the water and cement contents have been reduced.

With vibration the quality of the

CONCRETE VIBRATORS *of electric type for compacting concrete at Norris dam.*

DISCHARGE END *of hose line for spraying concrete Gunite on walls.*

concrete is improved and a substantial economy results because vibration permits the use of a drier mix containing less cement, and permits the use of a greater percentage of large aggregate. Under difficult conditions the placement of concrete is made easier and compaction more effective and the work of adding patches on exposed surfaces after removal of forms is largely eliminated.

There are two general types of vibrators: the external type and the internal type. The external type, which was first used for mass concrete, consisted of a platform with a vibrator mounted on top. This has largely been displaced by the more effective internal vibrator. The principal use for external units is now largely on precasting forms or on screeds for concrete pavement placing, or for placing canal lining.

The internal vibrators have proved most efficient because the impact is entirely absorbed by the concrete and there is no loss of energy above its surface, and the tendency for aggregate segregation is practically eliminated. Where a charge of 6 or 8 cu.yd. of concrete is placed at one time with a reasonable amount of spread, a number of ball type electrical vibrators or air-driven cylindrical type vibrators can consolidate such a mass in relatively short time. It is important to have enough vibrators so that the rate of placing of concrete is not retarded.

For thin forms and pockets, flexible shaft vibrators with the power unit located outside and the vibrating element contained in a thin tube driven by a fully inclosed flexible shaft or circulating oil under pressure have proved satisfactory. The rapid strides in the design of vibrators made to date indicate that the future will probably see additional new developments. The present trend is toward higher frequencies and higher amplitudes of vibration. From 5,000 to 7,000 impulses per minute are considered desirable, and where these are not obtained through standard 60-cycle power sources, a frequency converter is a necessary addition to the vibrating equipment. The bearing design is of utmost importance in vibrators, and above all the equipment must be regularly serviced and overhauled to prevent local failures.

Compressed air vibrators are free from electrical troubles and are readily adapted where air is available for clean-up and other purposes. However, the air hose connected to the vibrators is more cumbersome than the smaller electric cable.

**Heavy-Duty Cableway Installations**

| DAM PROJECTS | NO. OF CABLE-WAYS | CAPACITY | SPAN | TRACK CABLE Diameter | HOIST POWER | HEAD TOWER | | TAIL TOWER | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Height | Type Traveling or Fixed | Height | Type Traveling or Fixed |
| | | Tons | Ft. | In. | HP. | Ft. | | Ft. | |
| OWYHEE | 1 | 25 | 1,306 | 3 | 400 | 65 | T | 45 | F |
| MADDEN | 1 | 25 | 1,325 | 3 | 400 | 100 | T | 100 | T |
| BOULDER | 2 | 25 | 2,575 | 3 | 500 | 90 | T | 90 | T |
| | 2 | 25 | 1,405 | 3 | 500 | 75 | T | 42 | T |
| | 1 | 25 | 1,365 | 3 | 500 | 98 | F | 16 | T |
| MORRIS (PINE CANYON) | 2 | 15 | 960 | 2¼ | 300 | 100 | F | 35 | T |
| NORRIS | 2 | 18 | 1,925 | 3 | 500 | 75 | T | 110 | T |
| BONNEVILLE LOCK & POWER HOUSE | 2 | 15 | 1,390 | 3 | 400 | 145 | F | 75 | T |
| BONNEVILLE SPILLWAY | 2 | 20 | 2,020 | 3 | 500 | 90 | T | 223 | F |
| PARKER | 3 | 25 | 1,500 | 3 | 500 | 75 | T | 42 | F |
| CONCHAS | 2 | 15 | 1,650 | 2¼ | 250 | 145 | T | 175 | F |
| HIWASSEE | 1 | 18 | 1,575 | 3 | 500 | 75 | T | 110 | T |
| MARSHALL FORD | 1 | 25 | 2,100 | 3 | 500 | 75 | T | 177 | F |

**Forms**

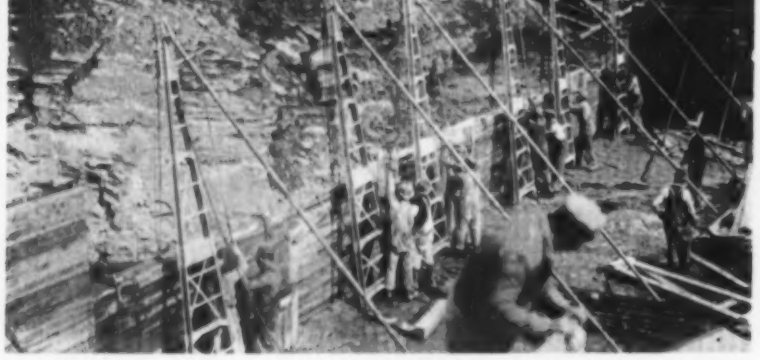
The subject of forms deserves a great deal of study because on the average lock and low dam project forms represent from 30 to 40 per cent of the cost of concrete and on high dams from 15 to 20 per cent of such cost. One of the first questions is: To what extent can panel forms be used and reused, and to what extent is it necessary to build "in-place" forms. This requires advance consideration of the total square feet of coverage, the square feet of uniform surface, form-handling facilities, capacity of the concrete placing plant and expected output, the height of lift, pressures against forms based on the rate of rise of concrete, and the cost of labor.

Panel forms, as a rule, are economical where they can be used five times or more. Panel forms are still in the development stage, and great economies are still possible in improving their design and use. In the past it has been largely left up to the carpenter foreman to work out a standard panel and then make many hundreds of them, but more recently the advantages of combining his experience with careful design and experimentation have disclosed the value of such precautions. In addition to sound and practical design, the use of good hardware and lumber, thorough supervision and speedy handling facilities are essential to the successful use of panel forms. Where these points are not fully realized, the extra labor cost of handling special panels may greatly offset their advantages.

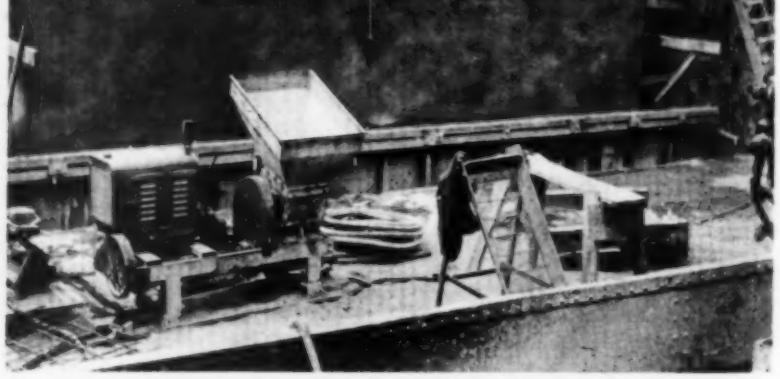
As an example of cost distribution in the handling of panel forms, the following is from a typical job:

PANEL FORM COSTS

| | Per Cent |
|---|---|
| Panel depreciation | 23.2 |
| Erection | 21.4 |
| Stripping | 8.0 |
| Safety Scaffolds | 1.9 |
| Hardware (embedded) | 19.2 |
| Miscellaneous | 23.3 |
| Total | 100.0 |



ALUMINUM A-FRAMES *and ratchet hoists used for raising heavy panels at Chickamauga dam.*



SHOTCRETE *equipment used for spraying concrete.*

There has been a tendency to use steel panels for large dams but in almost every case it was concluded that lumber panels would be more satisfactory. This is largely so because of the many special structural or architectural features that must be incorporated on the face of the dam, and in addition it is necessary to support reinforcing steel and a large variety of piping and inserts which require the cutting or penetration of panels for pipe, electric conduits, and similar elements. Furthermore, the weight of steel panels places a limitation on their size and usually requires a larger number to be handled than is necessary when lighter timber panels are used. As a rule, steel reusable forms are best adapted to continuously recurring types of structure such as tunnel linings, culverts or walls of a great length, or for arch centering where there are a large number of duplicate arches. As a general thing, the steel traveling forms have not been found satisfactory for navigation lock walls because of the many non-uniform features that occur in such structures.

On the Madden dam project 400 panels were used in the "double row step-up" method. These were made up of No. 1 Douglas fir for 5-ft. lifts by 14 ft. long, each weighing about 1,200 lb., and consisted of eleven 2x6-in. vertical studs, 2x6-in. sills, 1x6-in. sheathing, 6x6-in. waler, and were faced with 16-gage metal. All junctures were bound with metal bands and the panels were very rigid, could stand considerable abuse and still were relatively light to permit easy handling by a crew of 3 men, as shown in one of the illustrations.

At Norris dam the double row of panels was also used, employing 470 panels, each for a 5-ft. lift by 14 ft. average length, and were made considerably heavier, namely about 2,050 lb. For handling the panels a special small crane was employed which could travel on top of the completed concrete surface. This was moved from block to block by the overhead cableway.

On the Chickamauga lock and dam the single row sliding panel system was used; 220 panels were made up, each 12 ft. high by 14 to 18 ft. in length. Most of the concrete was placed in 10-foot lifts. An innovation in the panel form design called for a steel channel top sill (previously introduced at Pickwick Landing dam) to displace the usual timber waler. On large panels this channel sill has a number of advantages in simplifying the structural arrangement of the panel members and in serving as the point of connection for the tierods which are embedded in the concrete. (See illustration of panels in preceding chapter, p. 64. The Chickamauga panels were made up of 1½-in. sheathing, double 3x10-in. studs spaced on 2-ft. centers, and were held in place by 2-in. pipe combination struts and tierods placed at 4-ft. centers.

Among the recent advances in panel design and use, in addition to the steel channel sill mentioned above, is the greater use of the single row sliding panel system over the double row "step-up" system which requires almost twice as many panels. The use of the latter system is justified where enough time is gained by stripping the lower row as soon as the upper form is filled to increase the rate of production of the concrete plant. Another important and desirable feature is the use of coarse threads on all screw fittings, which helps to speed up erection and stripping. While most heavy mass concrete is placed in 5-ft. lifts, 10-ft. lifts are far more economical in smaller structures, and such higher lifts should be employed wherever the quality of the concrete is not adversely affected thereby.

Of equal importance to the design of panel forms is the management of their handling. Materials should all be available at the beginning of a shift. The panels should be equipped with means for retaining all re-usable fittings to prevent their dropping off and causing a loss of time while replacements are obtained. The use of special A-frames for handling panels deserves considerable study as compared with tying up the heavy concrete handling cranes for such service. As a rule, when a crane is used it is tied up for a considerable period of time while holding a panel in place for proper bracing. Also, where the stripping is done by cranes, the panels are usually stored on the ground until a carpenter crew is available, and this means that the panels tend to become warped or damaged in such handling. The panels should be well oiled so that they will strip without difficulty. Safety scaffolds are important because they mean greater freedom of action for the men and greater speed.

Douglas fir is one of the most common types of lumber for form panels. On the TVA jobs southern yellow pine was used, designed with working stresses of 1,200 lb. per square inch in flexure and 125 lb. per square inch in shear. It is necessary, as a rule, to hold deflections down to ⅛ in. or less.

The sheathing should invariably be not more than 6 in. in width; 4 in. is better in order to maintain a true surface on the panels and to simplify repairs. Special surfacing of panels with steel plate or plywood usually causes water to run down along the smooth face of the forms before the concrete has set, which leaches out the cement and develops sand streaks; this defaces the surface of the structure.

There has recently been a trend toward designing panels unnecessarily heavy. Handbook data regarding the pressure of concrete against forms usually gives excessive pressures. In recent tests made by H. G. Roby it was found that the pressures depend on a number of variables, such as the rate of placement, the temperature of concrete, the cement content and the water content. In soft concrete placed rapidly up to 4 or 5 ft., the pressure against forms may correspond directly to the liquid pressure at the unit weight of concrete, but for greater heights the pressures do not increase in such proportions. In the dry mixes it is not feasible to develop full liquid pressures, and the effect of mechanical vibration is not transmitted over a large area of a panel to introduce excessive pressure.

**Concrete Spraying Machines**

A special method of concrete placing, particularly for surfacing or repairing buildings or walls, is known as the Gunite process, and a more recent modification by Westberg known as the Shotcrete process. In the Gunite process a mixture of cement and sand is prepared in a special mixing unit known as a "cement gun" which is subjected to air pressure, and this forces the mixture through a hose and special nozzle against the surface to be coated. In both processes the moisture is supplied to the sand-cement mixture at the nozzle through a separate water hose. There is a certain percentage of rebound sand which can be collected and used over again.

The Shotcrete equipment has a charging hopper in which a dry mixture of sand and cement is proportioned and a rotary feeding device transfers the mixture at a uniform rate to a pressure chamber where it is assisted toward the outlet by a revolving screw; here compressed air is admitted to carry the material through 1½ or 2-in. rubber hose to the nozzle. Conveying distance of 500 ft., together with a rise of 125 ft., have been employed. Shotcrete equipment is available in capacities of 3, 7, and 12 cu.yd. per hour, for which air compressors with ratings of 160, 300, and 500 cu.ft. per minute respectively are required. Operating pressures at the gun are between 28 and 45 lb., with the pressure at the compressor at about 60 lb. per square inch.

❖

**NEXT MONTH — Chapter 24 of the series on "Heavy Construction," by A. J. Ackerman and C. H. Locher, to appear in the December issue will deal with "Canals, Tunnels and Penstocks."**

# PULPIT

in form of steel frame on extended platform alongside driver's seat (*left*), aids operators in backing up big trucks carrying millions of yards of rock and earth to dumps and fills at Grand Coulee dam on Columbia River, in Washington. Driver leaves seat and stands up in pulpit (*right*), facing to rear, so that he can steer truck along desired route as it backs up before discharging load.

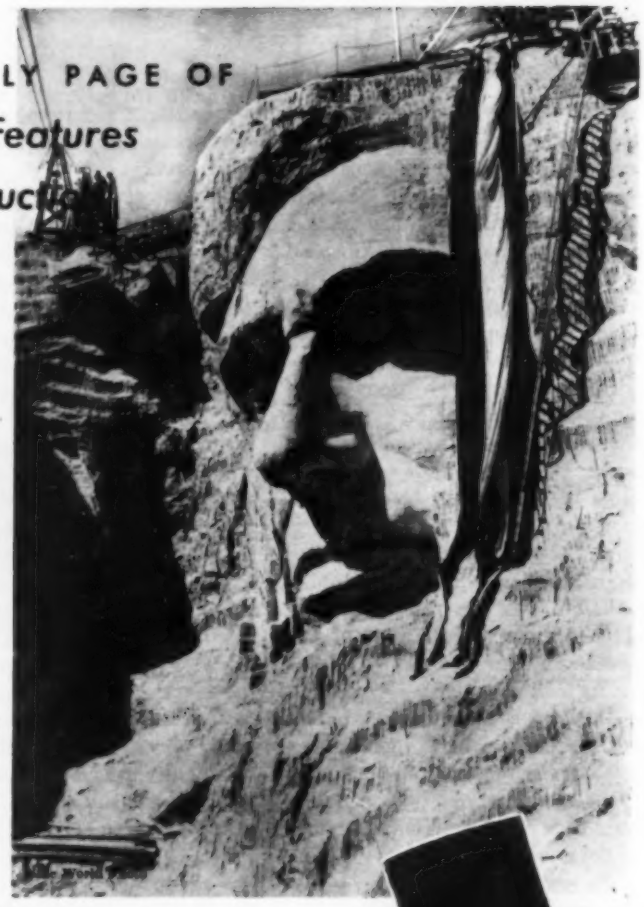
# JOB ODDITIES

A MONTHLY PAGE OF *Unusual Features of Construction*

Wide World Photo

## HOUSE AHOY!

*Moving day takes new marine form at Detroit, Mich., when wood frame residence is loaded on barge and shipped 25 mi. down Detroit River to site at Rockwood, Mich.*



## HEWN FROM GRANITE

*face of Mount Rushmore (right) at Rapid City, S. D., by rock drills is head of Abraham Lincoln, measuring 66 ft. from chin to crown. Ceremonies dedicating "Shrine of Democracy," including heads of Presidents Washington and Jefferson chiseled in mountainside by Gutzon Borglum, are held Sept 19.*

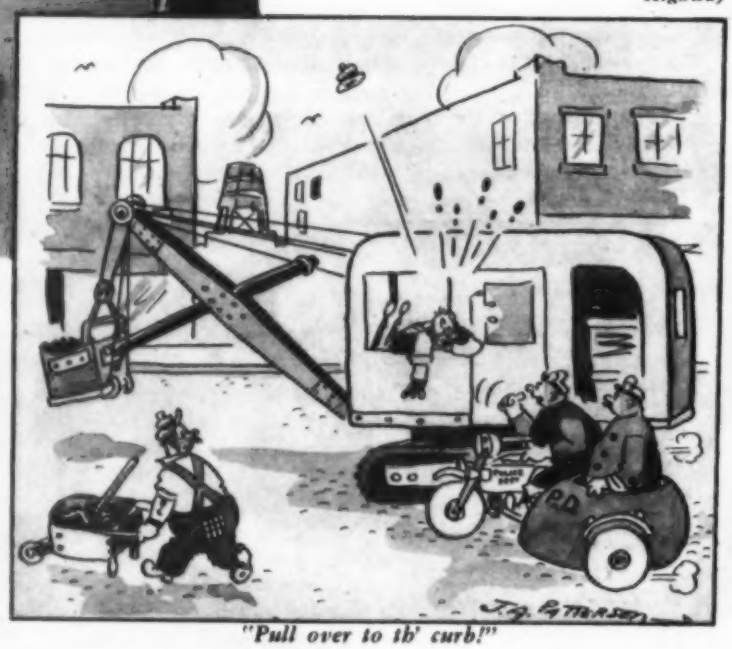
Authenticated News Photo

## DOUBLE DECK STREETS

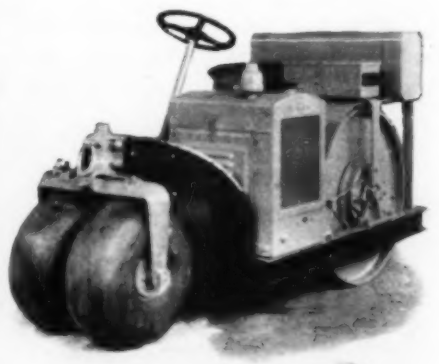
*offer pedestrians and bicycle riders in new Justus Van Effenstraat housing development safe passage two stories above ground level in congested section of Rotterdam, Holland. Bicycles (national vehicle) and delivery carts are raised by elevator to "Street in the Air," free from hazard of motor traffic.*

## GARGANTUAN PILE DRIVER

*of fearful and wonderful design is special equipment used to make official start Aug. 7 on construction of Louisiana's new bridge across Mississippi River at Baton Rouge. Governor Richard W. Leche, handling huge maul like a feather, administers first sock to substructure piling, as Harry B. Henderlite, state highway engineer, conceals grin behind upraised right hand. — Photo from N. E. LANT, bridge engineer, Louisiana Highway Commission.*



*"Pull over to th' curb!"*



## BALLOON TIRES

*of type used on airplane landing gear form front rollers on C. H. & E. 2-ton road roller operated by Michigan Colprovia Co., in Detroit. Special tire equipment provides kneading action in consolidating bituminous pavement surfaces.*

# Present and Accounted For~

A PAGE OF

## Personalities

**PUBLIC WORKS OFFICERS**

*named to serve American Public Works Association at annual meeting in Atlanta, Ga., last month are (left to right):* GUY BROWN, *engineer of sewer design, St. Louis, Mo., first vice-president;* J. EUGENE ROOT, *director of public works, Cincinnati, Ohio, president;* ROY L. PHILLIPS, *city engineer, Meadville, Pa., treasurer;* JOHN S. FLOCKHART, *assistant engineer, street cleaning, Newark, N. J., second vice-president.*

**NORTH DAKOTA HIGHWAYS**

*are now built and maintained under direction of* Z. E. SEVISON, *newly appointed state highway engineer, succeeding H. C. Frahm. Mr. Sevison is a former state highway engineer of Wyoming and city engineer of Cheyenne.*

**CHIEF OF ENGINEERS**

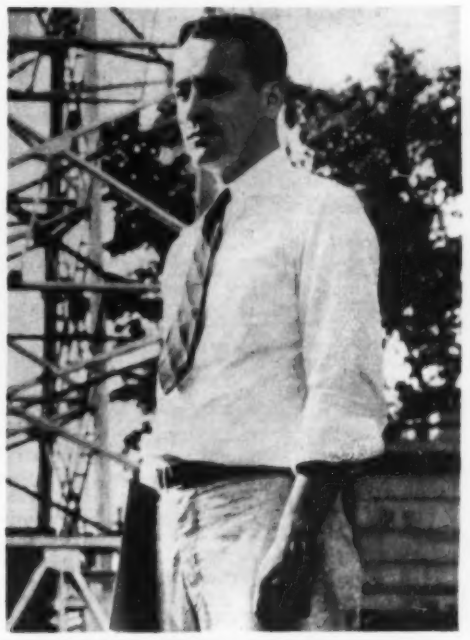
*(below) of U. S. Army is now* MAJOR GENERAL JULIAN L. SCHLEY, *appointed Oct. 18 to succeed Major General Edward M. Markham, retired. General Schley previously served as Governor of the Panama Canal and was in charge of construction of Madden dam, in Canal Zone. He was assistant to Engineer Commissioner of District of Columbia in 1913 and executive officer of first Public Utilities Commission in Washington from 1913 to 1916. He served as District Engineer at New Orleans, La., Galveston, Tex., and Nashville, Tenn. During World War he was engineer for Fifth Corps of A.E.F. in France.*

**JOINS DRAVO CORP.**

*(Below)* ADOLPH J. ACKERMAN, *co-author with C. H. Locher of the series of articles on "Heavy Construction," which have been appearing in "CONSTRUCTION Methods and Equipment" for more than a year, has resigned his post as construction plant engineer for Tennessee Valley Authority at Knoxville, Tenn., and has joined staff of Dravo Corp., contractor, of Pittsburgh, Pa., where he will engage in engineering and construction work for that organization. Mr. Ackerman was formerly chief engineer for contractor on Madden dam in the Canal Zone.*

**MOHAWK DAM DEDICATION**

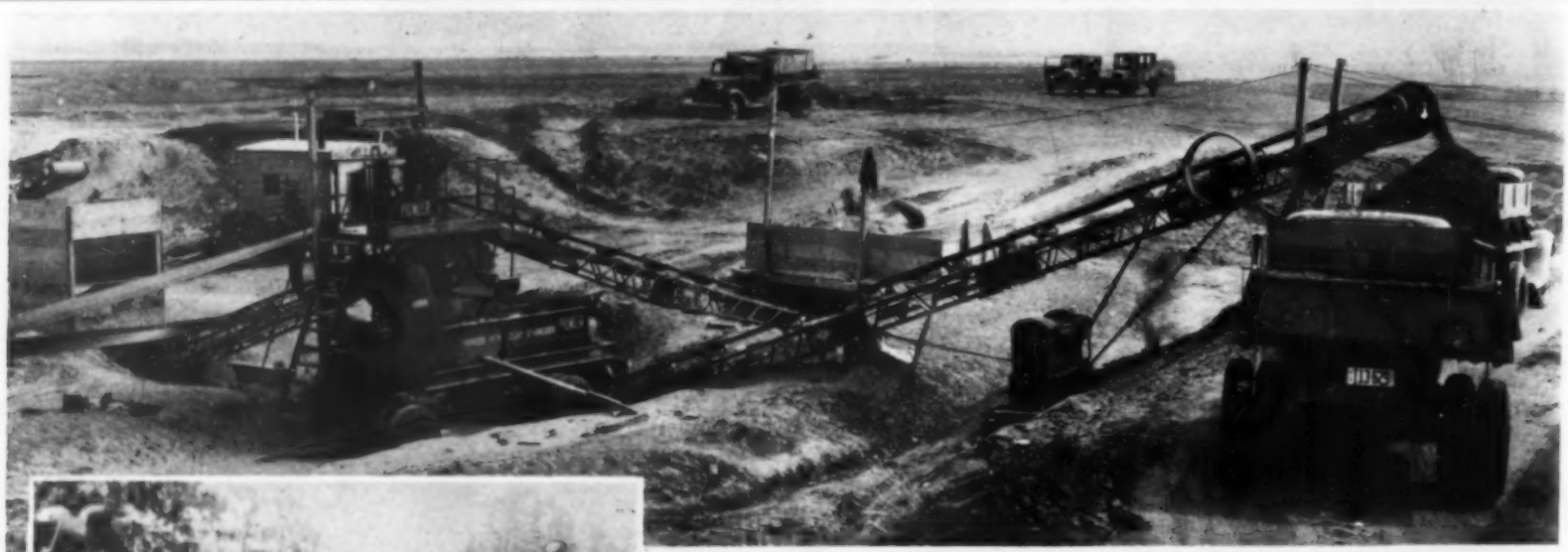
*occurs Sept. 23 in presence of engineers and contractors on flood control structure of rolled earth and rockfill type, 111 ft. high, for Muskingum Watershed Conservancy District in Ohio, built by George M. Brewster & Son, Inc., contractor, of Bogota, N. J., under direction of Corps of Engineers, U. S. Army. (Left to right)* CHARLES E. McKEE, *engineer for state highway department;* GLENN E. WALKER, *contractor's superintendent;* P. W. PATTERSON, *chief administrative assistant, U. S. Engineer Office;* CAPT. F. S. TANDY, *U. S. Area Engineer;* COL. R. G. POWELL, *Ohio River Division Engineer;* W. J. PAUL, *subcontractor;* LIEUT.-COL. J. D. ARTHUR, JR., *Zanesville District Engineer;* EDWARD F. O'NEIL, *contractor's general manager;* W. B. HOUSE, *U. S. Resident Engineer;* ALBERT VOUDER ESCH, *contractor's equipment foreman.*



# Construction Equipment News

(All rights reserved)

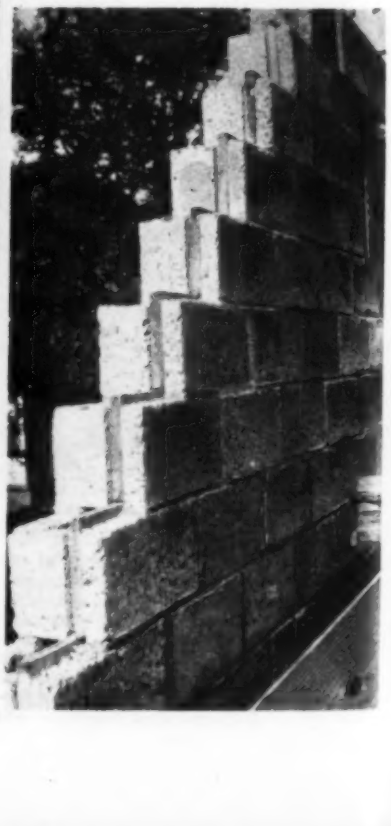
## Review of Construction Machinery and Materials for November, 1937



**ELECTRIC PIPE LINE WELDER (left),** obtainable in 300- and 400-amp. capacities, has following features: (1) Double sediment collectors for carburetor supply; (2) improved idling device; (3) gasoline tank, 36-gal.-capacity; (4) improved current switch; (5) close-coupled design; (6) lowered center of gravity of 1 ft.; (7) lightweight reinforced base and framework; (8) center lifting bail; (9) double radiator protecting grill. Distributor and other parts easily accessible. Battery or magneto ignition, optional equipment. — **Wilson Welder & Metals Co., Inc., Lincoln Bldg., New York City.**

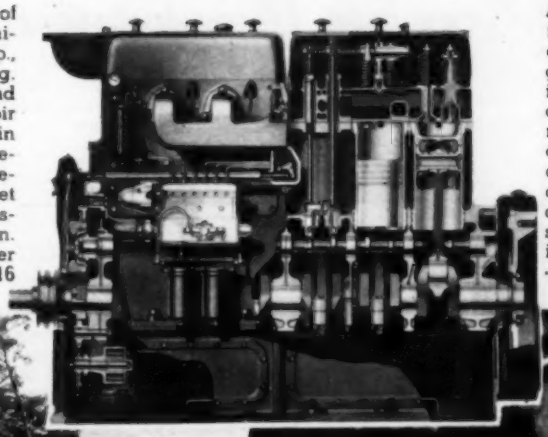
**PORTABLE SOIL STABILIZER PLANT (above)** operated by Graff Construction Co., near Inkster, N. D., has capacity of 85 cu.yd. per hour. Gravel is delivered from crushing and screening plants to left of conveyor and into pug mill. Clay is hauled to trough in center background where it is conveyed to disintegrator which shreds it and feeds it to pug mill. Water is then added and all materials are mixed. Finished stabilized material is delivered by conveyor to truck at right. Plant may be arranged to measure and feed calcium chloride or salt when its addition to mix is desirable. — **Pioneer Gravel Equipment Mfg. Co., 1515 Central Ave., N. E., Minneapolis, Minn.**

**DISK TAMPING ROLLER** is designed to pack bottom layers of material first and to build up solid structure which meets exacting specifications for important fills. Each 4-ft. disk revolves freely and independently of others, preventing skidding on sharp turns, and is formed to exert proper crushing pressure on large pieces of clay and other conglomerates. Individual disks lubricated by positive grease cup. Rear rakes provided for roughly leveling material after passage of roller. Offered with disks of 1¾-in. face widths as standard and in varying weights from 5 to 11 tons. — **The Parsons Co., Newton, Iowa.**



**CORK-INSULATED BUILDING UNIT (above and right)** made by vibrating nailable cinder concrete with 1 in., or more, of corkboard insulation cast integral with unit. Metal ties inserted in corkboard before concrete sections are joined, thus assuring secure bond. Corkboard offset so that when wall is laid it fits cork to cork forming continuous sheet around structure. Exterior finish may be Portland cement paint, or stain applied before or after building is erected. Compressive strength of block, 700 to 1,200 lb. per square inch. Weight 8x8x16-in. unit, 40 lb. Claimed to be waterproof, fireproof, vermin proof, to retard sound, prevent condensation and save fuel. — **Tricon Building Units, Sloatsburg, N. Y.**

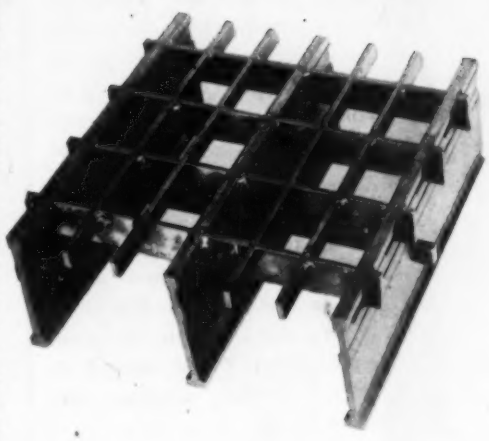
**DIESEL ENGINE (below and right),** for operation of shovels, hoists, draglines and other portable and semi-portable construction machinery requiring 125-185 hp., has crankcase and cylinder frame in one iron casting. Seven-bearing crankshaft supported in well ribbed and flanged cross walls. Box-type base serves as reservoir for circulating pressure oiling system. Hand holes in base permit easy access for adjustment and replacement of main bearings. Water circulation by positive-drive pump. Controlled ignition by electric spark. Wet sleeve cylinder liners may be renewed without disturbing other major parts. Two models, one with 6½-in. bore and 7-in. stroke, displacement, 1,395 cu.in.; other with 7-in. bore and 7-in. stroke, displacement, 1,616 cu.in. — **Waukesha Motor Co., Waukesha, Wis.**



**ALLOY STEEL ROD (below)** for gas welding is designed to meet demand for increased ductility and quality in both single and multi-layer steel welds. Outstanding feature: ability to withstand considerable heating without burning. Use of these rods gives 20 to 30 per cent free bend ductility of single layer welds depending on composition of steel and up to 40 per cent ductility of multi-layer welds on low and medium carbon steels. Ultimate tensile strengths in excess of 60,000 lb. per square inch. Specific gravity of welds, 7.80-7.86. — **Air Reduction Sales Co., Lincoln Bldg., New York City.**

**TRUCK MIXER** complete with power unit independent of truck motor is mounted on frame ready to be installed on chassis of proper size truck. Special features: (1) Streamline design; (2) essential parts inclosed for protection against cement dust and dirt; (3) three-point mounting of drum with flexible frame preventing misalignments; (4) proper center of gravity distributes load evenly on truck; (5) high tensile manganese steel drum shell, mixing blades, charging and discharging doors; (6) non-clogging mixing blades. Capacities, 1, 1½, 2, 3, 4 and 5 cu.yd.—**Ransome Concrete Machinery Co., Dunellen, N. Y.**

**ALL-STEEL OPEN BRIDGE FLOORING** combining light weight and strength for use on new structures and for replacing older types, such as wooden flooring, without increasing dead weight. Special extra-depth 5-in. beams form load carrying members of this "I-Beam Lok" open flooring. Beams are spaced 6 in. c. to c. with carrying 1¼x¼-in. cross bars intersecting at 3-in. intervals which, in turn, are notched at top to receive two ¾x¼-in. supplementary cross bars spaced equally between main carrying beams. Entire assembly produces steel surface with rectangular openings approximately 1⅝x2¾ in. Weighs 18.3 lb. per square foot. Is applied directly on stringer spacings up to 4-ft. and 4-ft. 6-in. centers. Does not require secondary supports. — **Carnegie-Illinois Steel Corp., Pittsburgh, Pa.**



1 . . . **UNTREATED house after 10 min.**

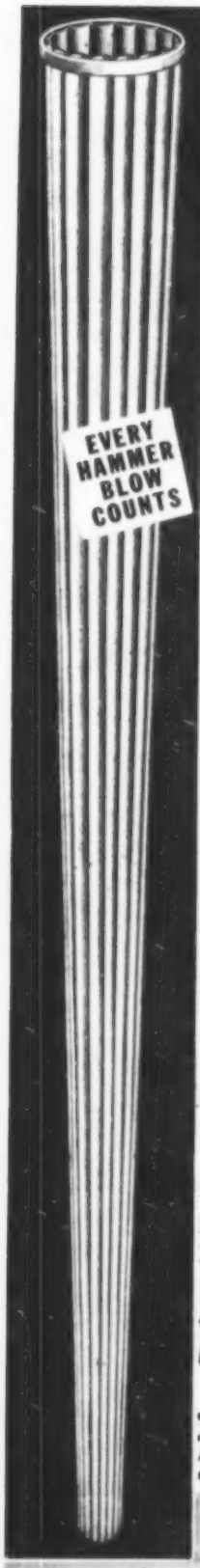
2 . . . **UNTREATED house after 18 min.**

3 . . . **TREATED house after 1 min.**

4 . . . **TREATED house and furniture after fire.**

**FLAME-PROOFING MATERIAL** was applied to one of two small furnished wood houses both of which were stored with excelsior and kerosene-soaked materials and set on fire for demonstration and test purposes at Detroit, Mich. Flame-proofing product is liquid that has had prior application in Germany. Three and one-half minutes after firing of treated and untreated test houses fire in flame-proofed house was under control — that is, it had burned itself out without serious damage to the building or its furniture. In the same 3½-min. period untreated house was fully ablaze and well on its way to complete destruction. Advantages claimed for the new flame-proofing liquid by its manufacturer, Roy R. Fisher, are: Flame-proof protection for wood structures, such as buildings, bridges, trestles, scaffolding, etc.; ready application; reasonable price. — **United States Flame Proofing Corp., 4461 West Jefferson Ave., Detroit, Mich.**

# EVEN THOSE JOBS "OUT IN THE STICKS" *Show a Profit with*




**UNION METAL** *fluted steel* **PILE SHELLS**

**Yes, even those isolated jobs, far from railway sidings and hard-surfaced highways, can be handled profitably with Union Metal Fluted Steel Pile Shells. You don't have the problem and expense of moving in cumbersome equipment because these shells can be driven by any crane equipped with standard leads and light hammer. Their light but sturdy construction makes for fast, economical handling. No complicated rig of slings is required for unloading. Just roll them off the truck and snake to the desired location.**

**They drive faster, too. Every hammer blow counts because, in addition to their light weight, these hollow metal shells are made sufficiently strong and rigid through cold rolling and fluted design to permit driving without core or mandrel.**

**Wherever your job, use Union Metal Pile Shells for cast-in-place concrete piling and you will add to your profits.**

***Write for new illustrated catalog.***

**THE UNION METAL MANUFACTURING CO.**
**CANTON, OHIO**

*• Union Metal Shells used successfully in construction of 12 trestles and bridges in Muskingum Conservancy District – all in remote locations.*

# *News from Manufacturers*

## ABOUT THEIR PRODUCTS

***The publications, reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.***

POZZOLITH, CONCRETE WATER-REDUCING AGENT — **The Master Builders Co.**, 7016 Euclid Ave., Cleveland, Ohio (19 pp. illustrated). Describes and illustrates use of ferric alumino silicate in liquid suspension having early-effective pozzolanic properties. Discusses use of product in concrete mixes to reduce water content as much as 33 per cent and to improve placeability of mix, resulting in less volume change and greater durability. Other advantages of Pozzolith described in book: density, watertightness, strength and corrosion resistance.

• • •

MAINTENANCE PAINTING MANUAL — **The Sky-brite Co.**, Cleveland, Ohio. (16 pp. illustrated). Describes specialized paint and cleaning products offered for plant maintenance, such as wall finishes, heat-, acid-, and alkali-resisting aluminum and black paints; "Rust-Tox" in various colors to be applied over rust; non-bleeding calking compound; concrete and masonry paint; factory glass cleaner; roof primer, fiber roof coating and roof patching cement; quick acting rust solvent; "no-glare" window coating; concrete floor enamel; colorless floor and woodwork varnish. Of special interest is application chart which shows in handy form proper product for each type of surface and condition. Full information regarding coverage, application and special uses.

• • •

RUBBER FLOORING INSTALLATIONS — **Goodyear Tire & Rubber Co.**, Akron, Ohio. (95 pp., illustrated, loose-leaf 8½x11-in. portfolio.) Interesting to architects, contractors and others contemplating construction of new business buildings and dwellings or in remodeling of present structures. Contains photographs of most common applications of rubber flooring, both of rubber tile and roll varieties. Brief description of product on first page and photographs are relied on to tell their own story throughout rest of book.

• • •

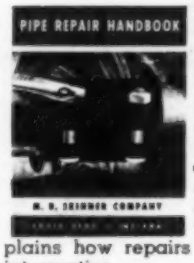
ROCK DRILLS AND OTHER TOOLS—**Independent Pneumatic Tool Co.**, 600 West Jackson Boulevard, Chicago, Ill. (60 pp., illustrated). Information and specifications and cross-sectional drawings of Thor rock drills, paving breakers, clay diggers, backfill tampers and related tools and accessories. Drill types include several sizes of sinker, from lightweight machine for holes of average depth to heavier units for deep-hole drilling and shaft sinking. Also the auger drill for work in loose or soft material. Stopers and drifters are available in various sizes and types. Rock drill columns, bars, arms, saddles and clamps. Air and water hose fittings. Rock drill steels and detachable bits. Line includes portable air-operated sump pump with automatic lubricator. Several pages are devoted to small pneumatic and electric tools, including drills, grinders, riveting hammers, etc.

• • •

FIRE PROTECTION SYSTEM — **Walter Kidde & Co., Inc.**, 60 West St., Bloomfield, N. J. (8 pp., illustrated.) In color brochure entitled, "Lux Makes the Difference," manufacturer explains and illustrates what a built-in carbon dioxide fire protection system means to thousands of industrial plants and electrical properties. While not technical in content, booklet furnishes valuable information to those in charge of maintenance and protection of properties wherein electrical or flammable fire hazards are encountered.

• • •

DIESEL ENGINE STARTING PROBLEMS — **Electric Storage Battery Co.**, 19th & Allegheny Ave., Philadelphia, Pa. (15 pp. illustrated.) Booklet entitled, "Electric Starting of Diesels," outlines problems of diesel starting and describes methods employed in Exide research laboratories for collecting data to be used in designing batteries for this kind of work. This laboratory work includes elaborate tests with diesels in a "cold room" and has been necessary because, as pointed out, "in diesel engines particularly, slight changes in design may make wide differences in starting requirements.




PIPE REPAIR HANDBOOK — **M. B. Skinner Co.**, South Bend, Indiana. (12 pp. illustrated.) For engineers, superintendents and maintenance men responsible for pipe-line maintenance. Discusses various kinds of leaks in pipe lines — holes, splits, pitted and corroded sections. Also joints of various kinds, such as threaded joints, bell-and-spigot joints, welded joints, collars, etc. Explains how repairs may be made without service interruption.

• • •

BILGE PUMPS — **Yeomans Brothers Co.**, 1433 Dayton St., Chicago, Ill. (20 pp. illustrated.) Reduces not-to-well understood details of pump construction to simple charts and diagrams and covers widely different applications and adaptations. Tells how to select proper type of bilge pump, describes features of Yeomans models and lists available extra equipment. Specifications and selection charts.

• • •

SPRAY PAINTING EQUIPMENT — **Binks Manufacturing Co.**, 3114 Carroll Ave., Chicago, Ill. (60 pp. illustrated.) Covers, with description and prices, whole line of spray painting and finishing equipment — spray guns, pressure painting outfits, spray booths, air compressors, pressure material tanks, hose and connections, respirators and masks, air and paint regulators, oil and water extractors, water wash equipment, exhaust fans, paint circulating systems and all accessory spray painting and finishing equipment.

• • •

INDUSTRIAL PRODUCTS—**Johns Manville**, 22 E. 40th St., New York City. (64 pp., illustrated.) Information and recommendations on high and low temperature insulations for every industrial need. Specifications on bonded asbestos built-up and insulated roofs. Detailed information on corrugated Transite for roofing and siding; on industrial friction materials; on Transite electrical conduit and Korduct, asbestos ebony and other electrical materials; on Transite pressure pipe for industrial and municipal water lines; on Transite industrial vent pipe and stacks; on packings and gaskets. Also in detail are described: industrial flooring plank, asphalt tile flooring, Steeltex floor lath, welded wire reinforcement and materials for sound control of mechanical equipment.

• • •

SNOW REMOVAL—**Linn Manufacturing Corp.**, Morris, N. Y. (4 pp., illustrated.) Describes new Linn snow fighters — newly designed tractors equipped with snow plows offering speeds up to 11.8 m.p.h. and powered by 610 ft./lb. torque gasoline engines. Diesel motors also can be supplied.

• • •

DIESEL ENGINES — **Caterpillar Tractor Co.**, Peoria, Ill. (14 pp., 4 x 9 in., illustrated). The "Whys and Hows" of diesel engine design and operation explained in simple terms with aid of sketches that make clear how various parts are interrelated and function.

• • •

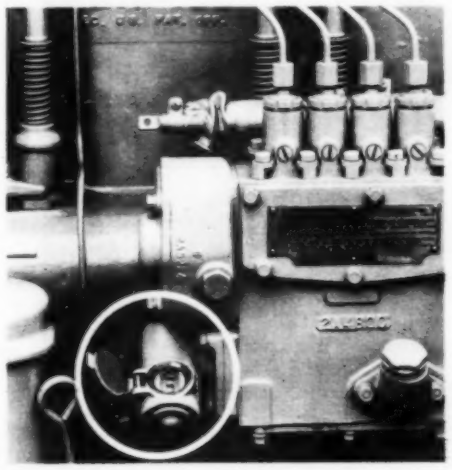
PORTABLE COMPRESSORS — **Sullivan Machinery Co.**, Woodland Ave., Michigan City, Ind. (24 pp. illustrated.) Describes complete line of two-stage, portable air compressors and contains data of value to those concerned with application of air compressors and air tools to construction and maintenance work. Copies may be had on application to company's agents or representatives or to the factory directly.

• • •

HARD FACING — **Haynes Stellite Co.**, Kokomo, Ind., (104 pp., illustrated.) New and more complete edition of booklet, "Hard Facing With Haynes Stellite Products," has just come off the press. Describes and illustrates more than 500 money-saving applications of hard facing process. Describes uses in agricultural, automotive, brick, cement, coke and gas, excavating, iron and steel, lumber and paper, machinery, mining, oil and gas, power, glass and aluminum fields. Describes hard facing procedure and lists metals which can and cannot be treated by this process. New sections present information concerning special J-metal cutting tools and corrosion-resistant Hastilloy alloys. Number of examples of hard facing automotive and aircraft valves and valve seat inserts and use of Haynes Stellite trim for high temperature, high pressure steam valves also described in detail.

# Construction Equipment News

**HOUR METER** for guidance in lubricating and maintaining Caterpillar diesel engines is now standard equipment on all three-, four- and six-cylinder engines. This unit, with large, easy-to-read dial, is

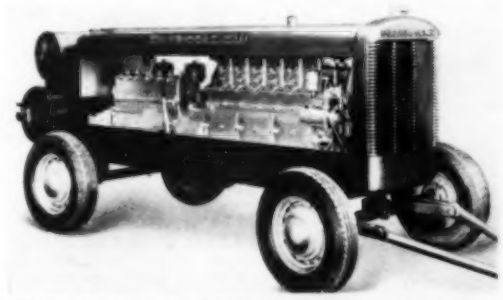


attached to rear of fuel injection pump housing and is driven by end of shaft, fitting between heads of cap screws in end of fuel injection pump camshaft. Registers one number for every hour engine operates at standard rated speed. — **Caterpillar Tractor Co., Peoria, Ill.**

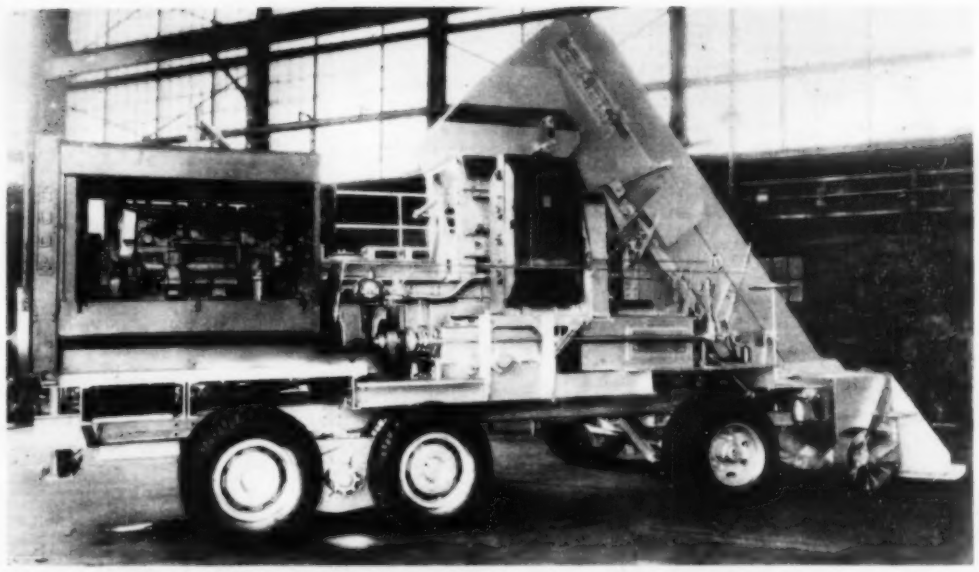
**HEAVY PATTERN WRENCHES** designed for severe service have heads approximately same thickness as nuts they serve. Comparatively thin head walls for efficient work in close quarters. Openings range

from 1¼ to 3⅛ in. Drop-forged in two types: carbon steel wrenches and chrome-molybdenum "Superrenches." Carbon wrenches finished in black enamel with bright heads. "Superrenches," chrome-plated with faces of heads buffed bright. — **J. H. Williams & Co., 75 Spring St., New York City.**

**DIESEL-POWERED AIR COMPRESSOR,** 210-c.f.m. capacity, is compact lightweight portable or semi-portable unit with following improvements: (1) Lightweight and small size contributing to portability; (2) ample bearing surfaces and proper lubrication assuring longer life; (3) water-cooling system effective in all climates and under all conditions; (4) low

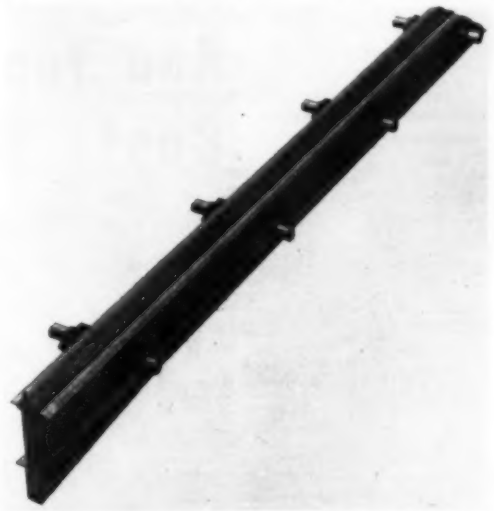


upkeep expense. Designed to operate at full-engine speed permitting direct connection to engine without reducing gears or belts and without sacrificing engine horsepower. Engine is four-cycle, six-cylinder medium-high speed designed to permit easy inspection and servicing. Compressor available with wooden skid, steel wheel, solid or pneumatic rubber-tired wheel, two- or four-wheeled trailer and motor or railway truck mountings. — **Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill.**



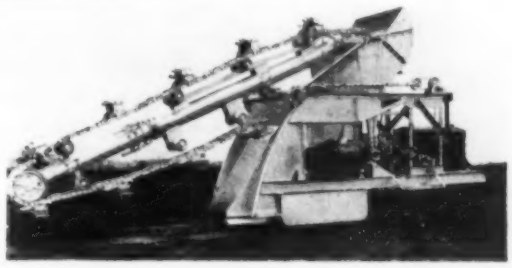
**DIESEL-POWERED TRAVELING ROAD-MIX PLANT** is equipped with 6-cylinder Buda engine with 5¼-in. bore and 7-in. stroke and has 909-cu.in. displacement. This engine has "controlled turbulence" combustion system which offers following advantages: lower compression ratios, lower maximum cylinder pressures, lower piston temperatures, higher mean effective pressure and lower specific weight. These advantages are said to assure less bearing wear, more power and less wear on all reciprocating parts, longer life, minimum maintenance and smoother operation. Asphalt mixer, manufactured by Iowa Manufacturing Co., of Cedar Rapids, Iowa, has 1,000-gal. supply tank equipped with kerosene pressure burners for maintaining even temperatures of bitumen in tank during operation. Aggregate batcher is synchronized with asphaltic material measuring pump and every operation is so regulated that materials are mixed in proper proportions. —**The Buda Company, Harvey, Ill.**

**"T-G BAR"** provides dependable connecting support at joint between concrete pavement slabs, to eliminate vibration during load transfer and at the same time to permit free lateral slab movement during temperature changes. Consists of pair of stress reducers, metal sleeve, dowel and two caps for closing ends of sleeves and sealing lubricant therein. Stress reducers and sleeves are made of heavy galvanized steel stampings and affinity of zinc coating



for concrete results in permanent bonding with these parts. Dowel is smooth, round cold rolled bar fitting tightly within sleeve which, when lubricated, forms metal bearing and allows it to float freely during expansion and contraction periods and in load transference, never coming in contact with concrete. Stress reducers die-formed of heavy-gage steel consist of two pieces held together by four rivets, two on each bond wing. Wings lie in horizontal plane of slab and provide additional bearing surface in concrete of approximately 11½ sq.in. T-G Bar is assembled at factory and comes to job ready for installation and should be set in joints 20 in. c. to c. — **Five-Way Expansion Joint Co., 20 N. Wacker Dr., Chicago, Ill.**

**SERVICE DITCHER** has shiftable boom which enables machine to dig close to curbs, trees, poles and other obstructions. Boom rides on two heavy steel tubes and is readily moved to either side or to any intermediate point bringing edge of ditch to within 4 in. of outside of Alligator tractor treads or within 10 in. of overall clearance. Overall width of machine, 6 ft. Tubular boom construction. Two telescoping sections provide means of adjusting boom for normal maximum cutting depths of 6, 8 or 10 ft. Cutting widths from 16 to 30 in. Twenty selective gear speed changes forward and four reverse giv-

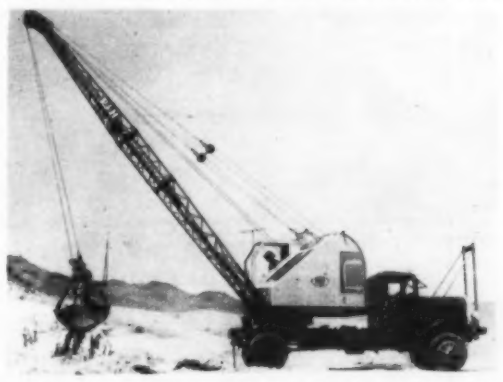


ing choice of digging speeds from 2.6 to 89 in. per minute. Provision made for digging while machine is tractioning backward, thus permitting close work on foundation, manhole and sidewalk jobs.—**Buckeye Traction Ditcher Co., Findlay, Ohio.**

**RUBBER TOOL RETAINER** for use on Wodack combination "Do-All" electric hammer and drill holds cutting tool in place and serves as dust cap to keep

grit out of hammer socket in overhead drilling. Fits over nose of hammer and allows cutting tool correct amount of play for rapid drilling or cutting. — **Wodack Electric Tool Corp., Chicago, Ill.**

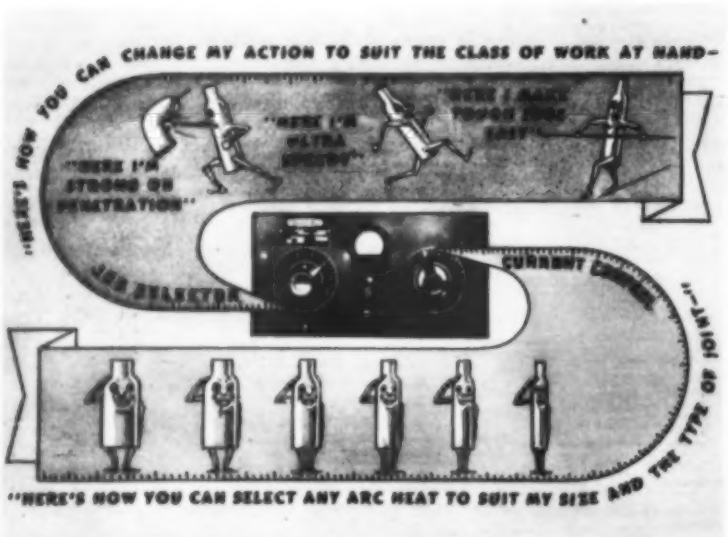
**LIGHTWEIGHT SHOVEL** ½-yd. capacity mounted on four-wheel-drive Oshkosh truck is being operated by U.S. Bureau of Reclamation in and around vicinity of Boulder Dam as general utility earth mover. Used



as shovel, crane or clamshell, according to its operators, it is unusually stable for such a small earth-moving machine. They claim that unit operating as shovel was able to load 40-yd. car in less than 19 min. — **Harnischfeger Corp., Milwaukee, Wis.**

*It took only 4 weeks to erect the 1314 tons of steel for this 200,000 sq. ft. industrial plant by shielded arc welding. Note the "tree form" design. Courtesy The Austin Co., Cleveland, O.*

# "Use Me With The New 'Shield-Arc SAE' And You'll Lower Welding Costs These 3 Ways"...


"HERE'S HOW YOU CAN CHANGE MY ACTION TO SUIT THE CLASS OF WORK AT HAND—
"HERE I'M STRONG ON PENETRATION"
"HERE I'M ULTRA SPECIAL"
"HERE I MAKE POWER JOBS EASY"
JOB SELECTOR
CURRENT CONTROL
"—AND THE TYPE OF JOINT—"
"HERE'S HOW YOU CAN SELECT ANY ARC HEAT TO SUIT MY SIZE AND THE TYPE OF JOINT—"

"ONE—You get better welds 15% to 20% faster because its Job Selector gives you the right TYPE of welding arc to suit the job.

"TWO—You cover a wider range of application because of its Dual Continuous Control. In effect, you get two or three welders of different ratings when you buy an 'SAE.'

"THREE—You can use me in my larger sizes—weld faster and continuously because the 'SAE' is self-protected against burnout.

"If you want yardage gains in welding, just play ball with Lincoln. Yours for lower welding costs,

**"FLEETWELD ROD"**
—Spokesman for all progress-minded welding electrodes and emissary of

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**LINCOLN "SHIELD-ARC SAE"**
**THE WELDER WITH DUAL *CONTINUOUS* CONTROL**

# BRUTES!

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IT TAKES a *he*-tire to do a dump truck's work. Even then—the toughest, sturdiest kind of tire must be suited to the job it's got to face if it's going to perform efficiently and economically.

That's why Goodyear offers you a choice of three great dump truck tires. They're big, tough, husky brutes—each one built to do a particular type of dump truck work better and longer than any other tire made—to make the toughest job easier—to dig in, pull through and hold up under the worst possible service without holding up your trucks or men. They save you time and money.

There's the All-Weather Dump Truck Tire (1) for all-around dump truck work; the Pneumatic Lug Tire (2) for trucks that plow through gouging, cutting, tread-ripping rocks and sharp stones; and the Goodyear Sure-Grip (3) that digs in without slipping in the worst kind of sloppy, soft or sandy going.

The difference in these tires is in the tread—each fitted to a different type of going. Underneath is the sturdiest, longest-lasting construction it is possible to build into a tire: Patented, pre-shrunk Supertwist Cord—blowout protection *in every ply;* specially-processed, chemically-toughened rubber in both tread and body; braided wire beads.

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Sitting in a comfortably cushioned seat, operating short, easy-throw levers and pedals, he exerts a minimum of physical effort. He is not subject to efficiency destroying fatigue and is therefore able to keep the machine going at top speed all through the work shift.

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Development of Speed-o-Matic puts manual-lever operated shovels back in the class of hand-cranked automobiles.

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BIG PAVING JOBS
WARCO
Require the right equipment to prepare the grade with speed and economy.
The contractor who paved this Super-Highway recognized the stability of WARCO Motor Graders and completed the job in record time.
Write for Circular
W. A. RIDDELL CORPORATION - BUCYRUS, O.

"YOU'VE GOT SOMETHING THERE!
You've got *safety* with this Snap-on L-225 Set . . . for the sockets lock on automatically, yet release at the touch of a thumb button.
You've got *powerful* leverage to break loose the tightest large nuts and bolts — 24½" Combination Sliding Tee and Offset Handle, 24½" Ratchet and Nut Spinner, aided by three extension bars of 3", 8" and 16" lengths.
You've got *speed, light weight* and the *strongest* steel that can be put into a wrench.
"You've got something there" when you tackle any heavy duty servicing with heavy-duty Snap-ons . . . you put trucks, tractors, graders, pavers, loaders, ditchers and other heavy duty machinery back on the job in the shortest time.
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REPEAT orders tell the story of service on machines of 3/8, 1/2, 5/8 and 3/4 yd. capacities just as they do on larger machines. Firms like Blythe Brothers of North Carolina don't buy again where service is inferior. Here is the first of the smaller Northwests purchased by this well known southern firm. The high quality of service rendered was responsible for the purchase of two more of the smaller Northwests by Blythe Brothers, making a total of twelve Northwest machines bought by this concern.

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12 NORTHWESTS for BLYTHE BROS.

Northwest 3/8, 1/2, 5/8 and 3/4 yd. shovels, cranes and draglines bring you a combination of features not found in other machines of these capacities. These advantages assure longer life, smoother swing, easier control, better steering, smoother travel and higher output.

NORTHWEST

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## FOR INSTANT AIR POWER

SCHRAMM 105 DeLuxe "Utility" Compressor. Insert showing instrument panel with gauges and starting button.

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## AIR COMPRESSORS

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SUPERIOR DROP-FORGED TOOLS

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## *Proved by test*

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**With more than 50 years' experience to guide them, Williams' engineers set out to design a heavy-duty ratchet wrench *powerful* enough for severest service and *strong* enough safely to withstand the generous leverages provided. The "Superector" incorporates many improvements in ratchet wrench design and construction. Quadruple pawls and drop-forged handle are just two "Superector" features which contribute to its sensational strength and comparative lightness.**

**The "Superector" has been subjected to exhaustive tests which thoroughly demonstrate its unusual strength. Competitive tests with other ratchet wrenches lead us to believe that Williams' "Superector" is the strongest wrench of its type today.**

**The "Superector" is available in 5 sizes — 24" to 53" — for both hex and square sockets 1" to 4-⅝". The socket hole extends clear through, permitting rotation of nut on any length of bolt. Put The "Superector" to work on your tough jobs and you will find it not only cuts tool replacement costs and speeds up work, but will definitely reduce accident hazards.**

### *"Superector"* FEATURES

- Quadruple Pawls
- Drop-Forged Handle
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- Takes *both* Hex and Square Sockets

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## UNTIL IT'S INSTALLED

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• When you compare the time and money required for proper installation of various sewer materials, you'll quickly see the economy of Armco sewer pipe.

Due to its great strength and flexibility, this improved pipe needs no expensive cradles or special care in bedding. Unskilled labor can install it quickly and easily without special equipment. And remember, the long standard lengths of Armco sewer pipe save up to 1056 joints per mile.

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| Points to Consider in Preparing Sewer Estimates | |
|---|---|
| **A. Materials** | |
| 1. | Pipe—Type Specified and Strength Needed |
| 2. | Cradles—Type Required (if needed) |
| **B. Labor** | |
| 1. | Loading and Hauling |
| 2. | Excavation |
| 3. | Bedding—Type Needed |
| 4. | Laying, Lining and Joining |
| 5. | Backfill, Including Tamping |

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A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

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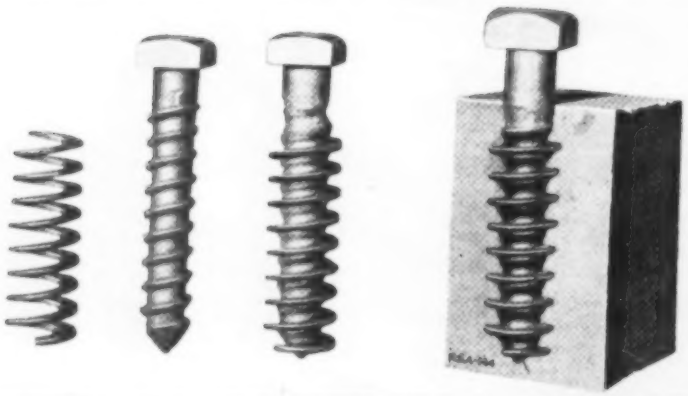


## IT'S SECURE!

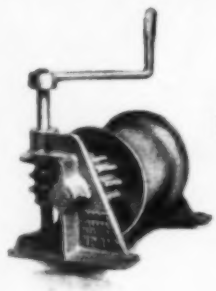
Wherever a fool-proof fastening to concrete is required — there you'll find Richmond Screw Anchors doing the fastening! For whether your problem be one of securing stadium or auditorium seats or securing removable fenders on docks or platforms in industrial, railroad or marine construction — Richmond Screw Anchors assure absolute dependability.

That's because with a Richmond Screw Anchor all stress is transferred to the surrounding concrete. The Anchor cannot be loosened without destroying the entire masonry. Actual tests show that if the Bolt extends into the concrete a distance measuring ten times its diameter, the Bolt will fail before the Anchor can be pulled out. Made black or galvanized. If both Anchor and Bolt are galvanized, they are rust proof and form a removable fastening.

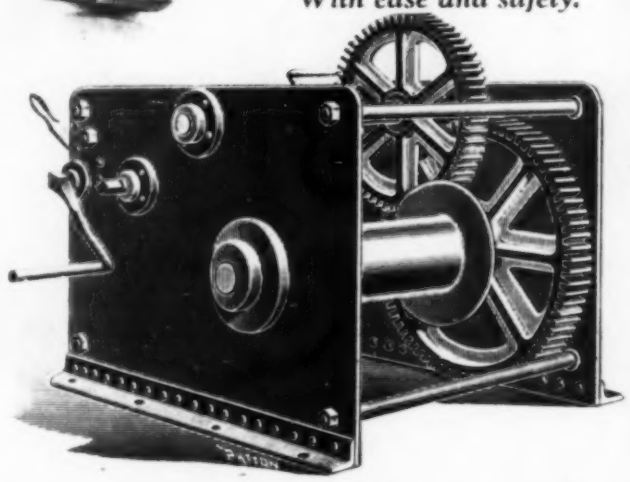
*Further details on how Richmond Screw Anchors and Bolts can save you time, expense and worry will gladly be furnished on request. Just drop us a line outlining your problem.*

**RICHMOND SCREW ANCHOR CO., INC.**
*Tying Devices for Concrete*
241-251 BUSH STREET — BROOKLYN, NEW YORK

## DOBBIE WINCHES



A Dobbie Winch for every purpose.
From 100 pounds to 50,000 pounds capacity on a single line.
*With ease and safety.*



**DOBBIE FOUNDRY & MACHINE CO.**
**Niagara Falls, N. Y.**
*Other Dobbie Products* — Steel Derricks, Timber Derrick Fittings, Hand Winches, Motor Driven Winches, Blocks, Sheaves, etc.

## K&E WYTEFACE
STEEL MEASURING TAPES

*Easy to read..*
easy to clean, and the crack-proof white surface protects the steel from rust. Ask your dealer, or write for complete information.

**KEUFFEL & ESSER CO.**
HOBOKEN, N. J.
NEW YORK CHICAGO ST. LOUIS SAN FRANCISCO DETROIT MONTREAL

# 500,000 LBS. OF DYNAMITE

*can raise a lot of DUST!*

**Read how Shell showed this construction company how to combat dangerous abrasive dust!**

EVERY construction man knows what abrasive dust can do to motorized equipment. But when the dust is being raised by blasts of dynamite totaling one-half million pounds—and that dust is of volcanic origin—that's a *real* dust problem!

J. A. Terteling & Sons of Boise, Idaho, faced this dust condition as they started construction work on the Roza Division of the Yakima Irrigation Project in the State of Washington.

To combat this dust problem J. A. Terteling & Sons called in Shell. Shell's thorough survey of conditions and equipment helped bring the dust problem under control.

The trained eye of the Shell man immediately recognized the need for certain mechanical adjustments to protect working parts against further abrasive dust, and recommended the correct lubricant needed to maintain greater efficiency in each piece of motorized equipment—draglines, tractors, compressors and others. Today, Shell is supplying all fuel and lubricant requirements on this job—over 1,500 gallons a day!

The success with which Shell met this problem is being repeated day after day on tough construction jobs all over the country.

Shell applies an "Invisible Element" to your particular problem—the resources of a great organization; the ingenuity gained from long experience in the field. This *plus* in lubrication is yours for the asking. Simply get in touch with your nearest Shell office.

SHELL

**SHELL *CONSTRUCTION* LUBRICANTS**

GOODALL RUBBER CO. INC.
G R C INC.
PHILADELPHIA

# *No Need for You to Guess What* THIS *is!*

Contractors everywhere have learned to recognize this Trade Mark as the symbol of quality . . . the assurance of long, dependable service . . . that identifies all

# GOODALL
## HOSE • BELTING
## RUBBER GOODS

It stands for 30 years of specialized experience in the manufacture of rubber products for contractor's use and *guarantees* the utmost in economy and satisfaction wherever such products are required.

It is the reason why you so frequently hear one "boss" say to another, in a tone of complete approval, "I see *you're* using Goodall, *too!*"

**GOODALL RUBBER COMPANY**

5 S. 36th Street, Philadelphia, Pa.

New York • Pittsburgh • Chicago • Cleveland • Houston

**GOODALL MECHANICAL CORPORATION**

San Francisco • Los Angeles • Seattle

FACTORY: TRENTON, N. J. *Distributors in Principal Cities*

**GOODALL** The originators of the "Standard of Quality" Line (Reg. U. S. Pat. Off.) of contractors rubber goods

## You Can Bet Your Life on LAUGHLIN DROP FORGINGS

LAUGHLIN Wire Rope and Chain Fittings are thoroughly dependable, accurately sized and cleanly finished.

Over 70 years experience and the facilities of a modern plant combine in placing at your service, industrial hardware of outstanding merit.

*Send for catalog showing the complete line.*

LAUGHLIN Pear Shape Missing Link (Patented)

LAUGHLIN Eye Hoist Hooks

LAUGHLIN Wire Rope Sockets, Open Pattern

LAUGHLIN Round Pin Shackles

**THE THOMAS LAUGHLIN COMPANY**

**Portland, Maine**

Manufacturers of Industrial and Marine Hardware Since 1866

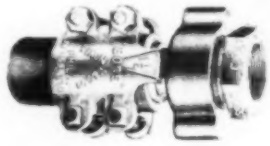
New York, Los Angeles, Chicago, San Francisco, Detroit, Seattle, New Orleans, Denver

## BETTER PERFORMANCE LONGER SERVICE ON ANY JOB

### "DIXON" AIR HAMMER COUPLINGS

**Designed and built to withstand the continual vibration of hand hammers and rock drills, this Dixon coupling has a longer, consistently economical service life on the toughest job. And, like the "Boss," it is rust-proofed by Cadmium Plating.**

### "BOSS" HOSE COUPLINGS



**Used for steam hose, steam hammers, air, hydraulic or road builders' hose . . . "Boss" Couplings have no equal for dependability in service. Parts are of steel or malleable iron to withstand abuse . . . Cadmium Plated for rust proofing.**

*Furnished in Washer or Ground Joint Type.*

# DIXON
## VALVE & COUPLING CO.

LOS ANGELES PHILADELPHIA HOUSTON

Carried in Stock by Leading Rubber Manufacturers and Jobbers.

# FINE FORMS MAKE FINE BUILDINGS

## *this money-saving way to build*

(*Main illustration*) Alabama Highway Department office building was designed and built as a WPA project under the direction of H. H. Houk, chief engineer, Alabama Highway Department; J. R. Adams, architect for the Department; and Warren, Knight & Davis of Birmingham, consulting architects. William Grant, Birmingham Sculptor, executed the waste molds used for form ornamental detail. This building is a unit of the new State Capitol Group as planned by Olmstead Brothers of Boston.

THINK OF BIDDING on one of the Architectural Concrete jobs that are popping up everywhere? There's a special construction technique which results in high quality at low costs.

Consider the new Alabama Highway Department building. The entire exterior was executed in concrete, and much of the interior also. Forms were designed to give sharp, well defined lines. Fiberboard and plywood form lining were used on exposed surfaces. With the exception of lining material used in forming cornice moldings, column caps and flutes, form lumber of ordinary dimensions was used throughout. Lumber was used many times, and most of it was salvaged in usable condition for other jobs.

To help you handle Architectural Concrete jobs profitably let us send you helpful free booklets covering the latest practice.

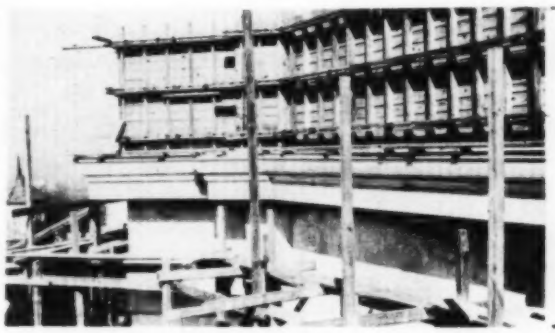
(*Above*) Waste mold and core in place for casting column cap.

(*Below*) Completed column cap and fluted column showing clean, sharp detail obtained in concrete.

(*Right*) Detail of cornice with forms in place for casting parapet.

***Architectural Concrete***

WALLS, ORNAMENT, FRAME AND FLOORS INTEGRALLY CAST



**PORTLAND CEMENT ASSOCIATION**

Dept. 11-16, 33 W. Grand Ave., Chicago, Ill.

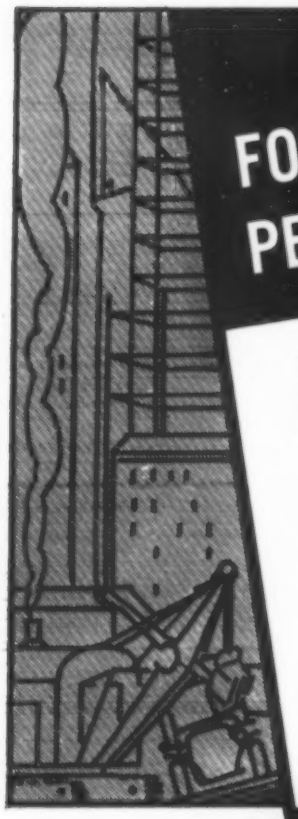
Please send me the manual *"Forms for Architectural Concrete,"* and also *"Concrete Guide with Tables of Quantities of Materials."*

*Name* .....

*Position or Company* .....

*Address* .....

.....



# FOR EXTRAORDINARY PERFORMANCE ON ANY CONSTRUCTION JOB

You will find it especially advantageous to equip your men with genuine Duff-Norton Jacks incorporating many exclusive features of design and construction made possible by over 50 years of specialization in quality jack manufacture.

Whether it's a job of lifting, lowering, pushing, pulling or bracing, you will find in the Duff-Norton line an efficient type of jack designed especially for the purpose—famous for performance all over the construction world.

Your Mill Supply Dealer will be glad to serve you.

**THE DUFF-NORTON MANUFACTURING CO.**
**PITTSBURGH, PA.**

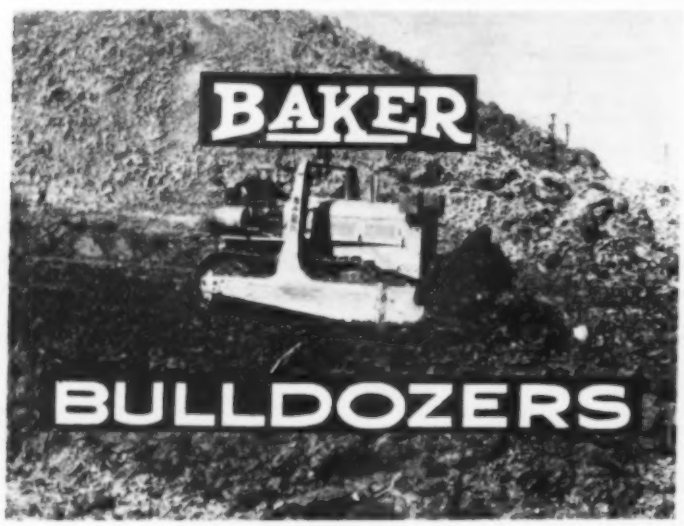
Duff-Norton Genuine Barrett Automatic Lowering Jack.

Duff-Norton Special 4-Way Chain Jack No. 1523.

Duff-Norton Ball-Bearing Bridge and Wrecking Jack with Forklift.

"THE HOUSE THAT JACKS BUILT"

# Duff-Norton Jacks




The ability to handle each job as it comes up with comparative ease has made Baker Bulldozers and Gradebuilders the top selection of leading construction companies.

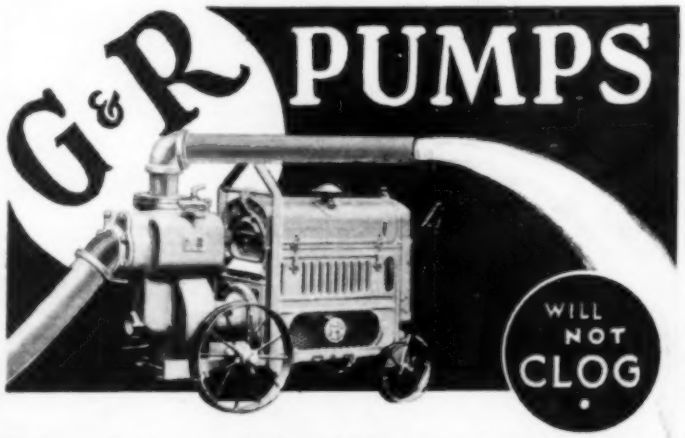
This simply-constructed Bulldozer with direct blade lift requiring no cranks, wheels, springs or levers and abounding in real money-saving features, will get you through the tough spots.

*Ask for Baker Bulldozer Bulletins*

**OTHER BAKER PRODUCTS:**

**ROAD ROOTERS, ROAD DISCS, MAINTAINERS, HYDRAULIC SCRAPERS, SNOW PLOWS**

**THE BAKER MANUFACTURING CO.**
**568 Stanford Ave., Springfield, Illinois**




***Claims*** **of fastest priming, highest suction lift, more gallons per minute, etc., *do not pump water.* On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.**

**Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water *under any condition,* than any other pump. We will ship you one and let you be the judge.**

**Remember this about G & R Pumps — THEY WILL NOT CLOG — THEY ASK NO TIME OUT. Play safe! Try a G & R Self-priming Centrifugal before you buy any pump this year.**

**Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.**

***The Most DEPENDABLE Pump for The Least Money***

**THE GORMAN-RUPP CO. Mansfield, Ohio**

# The Economical Road Builder

Don't let the first cost of wire rope fool you. It's the final cost that counts. And it's in the final cost that "Flex-Set" Preformed Yellow Strand always proves its economy in road building.

It's really the same Yellow Strand that contractors have learned to appreciate through many years — with this difference: The wires and strands are now *preshaped* to the helical form they occupy permanently in the finished rope.

But what a difference this makes! "Flex-Set" Preformed Yellow Strand is limp — handles and installs much easier and quicker. It splices easier, too, and is highly resistant to kinking, fatigue and drum crushing.

All this makes for long life — the long satisfactory life that means economy in road building. Try it!

## Broderick & Bascom Rope Co., St. Louis

**Factories: St. Louis, Seattle, Peoria. Branches: New York, Chicago, Seattle, Portland, Houston**

V-17 R2

# Killefer road equipment

Revolving Scrapers

Revolving Rippers

Regular Rippers

Road Discs, or Planers

Compacting Harrows

Oil-Mix Cultivators

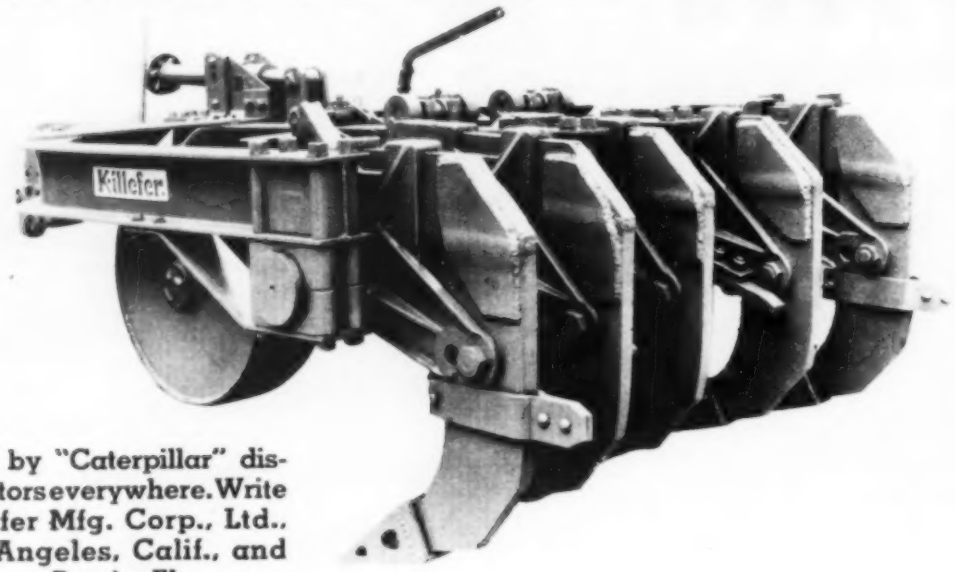
Ditchers

Mole-Drain Machines

■

Write for Literature

A REAL self-cleaning ripper. The toolhead rolls like a barrel to clear obstructions or stop digging. Great clearance under frame and between points (front to rear). Heat-treated standards and points. Working depth 14". Point spacing 18". One-rope control. Accurate depth adjustment. For tractors of 60 to 75 horsepower. Weight 7,580 lbs. Two smaller models. Write for folder R-64.




Sold by "Caterpillar" distributors everywhere. Write Killefer Mfg. Corp., Ltd., Los Angeles, Calif., and Peoria, Ill.

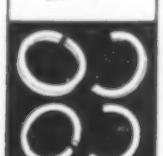
## No. 170 Revolving Ripper

### SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

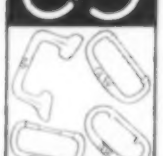
### STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.



### RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.



### CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

### STEEL BARREL CLOSURES

Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

### RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

* * * * * *

*Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.*

**THE NATIONAL LOCK WASHER COMPANY**

NEWARK, N.J.—EXPORT DIV., 15 E. 26 St., N.Y.C.

# HAISS EXCAVATOR

*For* **UNDERPASS, SUBWAY, ALLEY AND OTHER CLOSE QUARTER WORK** *because it digs and loads in a straight line.*

*For* **SHALLOW GRADING AND LIGHT EXCAVATING** *because of high work capacity without heavy investment.*

Handles any boulder-free material into which a workman can drive a pick. Bucket capacity—2¼ yds. per minute. Built to prove so efficient you'll want to own another. *Bulletin 530.*

**GEORGE HAISS MFG. CO. INC., 139th St. & Canal Pl., New York**

*Represented in all Principal Cities*

ASK FOR BULLETIN 331 ON FAMOUS HI-POWER CLAMSHELL BUCKETS

# GIANT TIRES MOVE MOUNTAIN

## *by* LOWELL THOMAS,
**NEWS COMMENTATOR**

• "They're cutting down Iron Mountain and hauling it away on Goodrich Tires. It's in

Shasta County, California. A mountain of low grade gold ore called 'Gossan,' heavy in iron.

"First they blast to loosen the ore. Then big shovels scoop up earth, drop it in huge trucks for the haul to the mill.

"No ordinary trucks are these. They're big fellows with specially-built bodies reinforced with *steel rails*. Bodies so rugged that they stand the crushing jolt of a three or four-ton boulder dropped from the shovel.

"Tires, too, must take terrific battering. No chance to reinforce with steel here—just rubber and fabric to take the shock—to carry 20-ton loads over sharp, jagged rocks. Trucks fight for a footing—wind their way down the mountain—the tremendous weight shifting from one tire to another—all in all a tire job believed impossible only two or three years ago. But these are Goodrich Silvertowns—'earth movers' weighing almost 500 pounds apiece. Tires developed by Goodrich engineers for just such service. They tell me these tires have a load capacity as high as nine tons each—that they provide super-traction—that this is one of the greatest achievements of tire engineers."

* * *

Not many truck owners have jobs such as this at Iron Mountain. But every owner wants to get the same long mileage, freedom from delays and low cost of operation.

Goodrich Truck Tires give that kind of service on every job. The same basic construction that makes the tires stand up on the job of moving Iron Mountain is now used in every Goodrich Silvertown! On your hauls, whatever they may be, you can now get long, trouble-free mileage at new low cost.

### TIRES TRIPLE PROTECTED

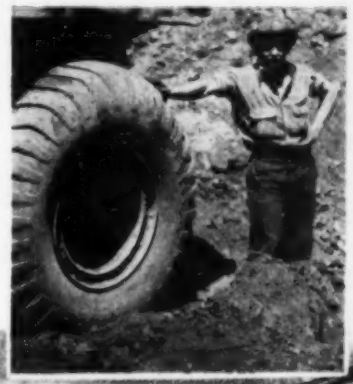
It's because these truck tires are Triple Protected in the sidewall. Built with an invention that checks 80% of premature failures. Only Goodrich gives you this 3-way safeguard:

**1** **PLYFLEX**—distributes stresses throughout the tire—prevents ply separation—checks local weakness.

**2** **PLY-LOCK**—protects the tire from breaks caused by short plies tearing loose above the bead.

**3** **100% FULL-FLOATING CORD**—eliminates cross cords from *all* plies—reduces heat in the tire 12%.

When you can get these tires without paying a penny premium, can you afford to take chances on tires without Triple Protection? See a Goodrich dealer today—ask him to give you proof of savings.



**Goodrich** *Triple Protected* **Silvertowns**

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

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THE FOUR WHEEL DRIVE AUTO CO.
FRUEHAUF TRAILER CO.
FULLER MANUFACTURING CO.
THE GALION ALLSTEEL BODY CO.
THE GALION IRON WORKS & MANUFACTURING CO.
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HETHERINGTON & BERNER, Inc.

*Will Other Contractors Underbid You in 1938?*

*Yes*– if you don't attend the

**1938 ROAD SHOW and CONVENTION**

*Because–*

they will have the advantage of seeing 6 acres of new machinery and material exhibits.

They will have the advantage of hearing 6 days of discussions of modern highway construction methods.

**COME TO**

**JANUARY**

*It Will Pay*

NEW MACHINERY

NEW IDEAS

AMERICAN ROAD BUILDERS' ASSN. · 1902 ·

NATIONAL in Significance
INTERNATIONAL in Scope!
Highway Contractors and Engineers; State, County and City Officials; Manufacturers and Distributors from every state in the Union and Road Builders from 25 foreign countries and a special Pan-American delegation will attend!
THE NATION'S FIVE STAR HIGHWAY EXPOSITION!
CLEVELAND
17-21, 1938
You Dividends!
NEW MATERIALS
NEW SPEAKERS
NEW ENTERTAIN-MENT
SEND YOUR HOTEL RESERVATIONS TO A.R.B.A. HOUSING COMMITTEE, 1604 TERMINAL TOWER, CLEVELAND, OHIO

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THE HUBER MANUFACTURING CO.
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THE OHIO OIL COMPANY
THE OSGOOD COMPANY
THE OWEN BUCKET COMPANY
PERFECTION STEEL BODY CO.
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PITTSBURGH STEEL COMPANY
PORTLAND CEMENT ASSN.
PUBLIC WORKS JOURNAL CORP.
R B EQUIPMENT CO.
RANSOME CONCRETE MACHY. CO.
W. A. RIDDELL CORPORATION
ROADS AND STREETS
ROGERS BROTHERS CORPORATION
ROOT SPRING SCRAPER COMPANY
ST. PAUL HYDRAULIC HOIST CO.
SAUERMAN BROTHERS, Inc.
SCHRAMM, Inc.
SIGNAL SERVICE CORP.
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SMITH ENGINEERING WORKS
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SPEEDER MACHINERY CORP.
SPICER MANUFACTURING CORP.
STANDARD OIL CO. OF CALIF.
STANDARD OIL CO. OF OHIO
STERLING MACHINERY CORP.
STOVER MFG. & ENGINE CO.
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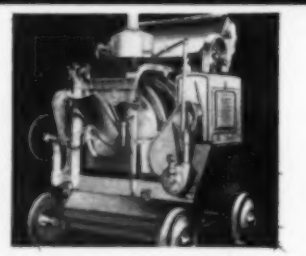

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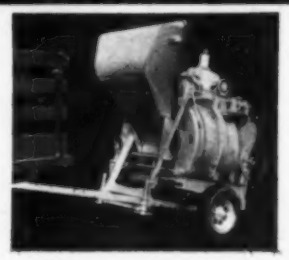

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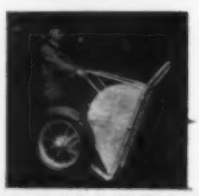

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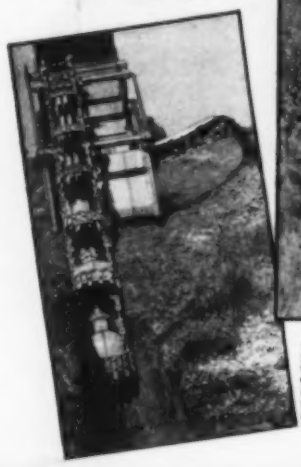

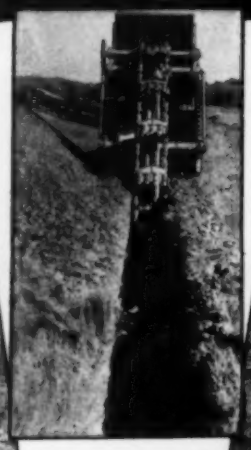

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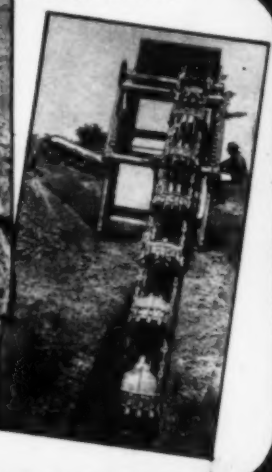

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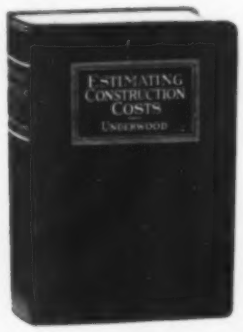


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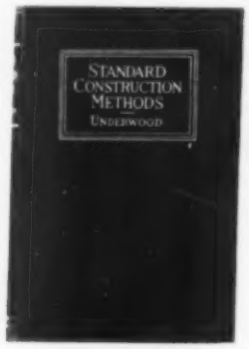


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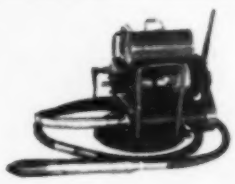
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Of Construction Methods and Equipment published Monthly at New York, N. Y., for October 1, 1937.

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared D. C. McGraw, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Construction Methods and Equipment, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., & Curtis W. McGraw, 330 West 42nd St., N. Y. C. Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw, 330 West 42nd St., N. Y. C. Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 33 West Grand Ave., Chicago, Ill. J. Malcolm Muir & Guaranty Trust Co of New York, Trustees for Lida Kelly Muir, 524 Fifth Avenue N. Y. C. F. S. Weatherby, 271 Clinton Road, Brookline, Mass Elsa M. Wilsey, Madison, N. J.

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

D. C. McGRAW, Secretary
McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 27th day of September 1937.

(Seal) H. E. BEIRNE,
Notary Public, Nassau County. Clk's No. 74, N. Y. Clk's No. 192
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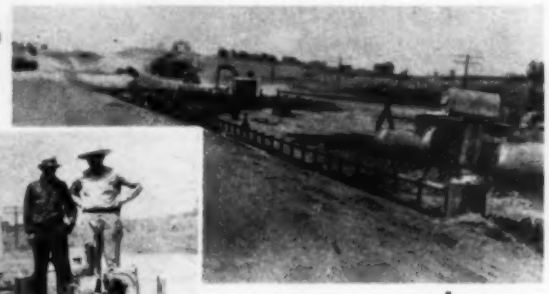

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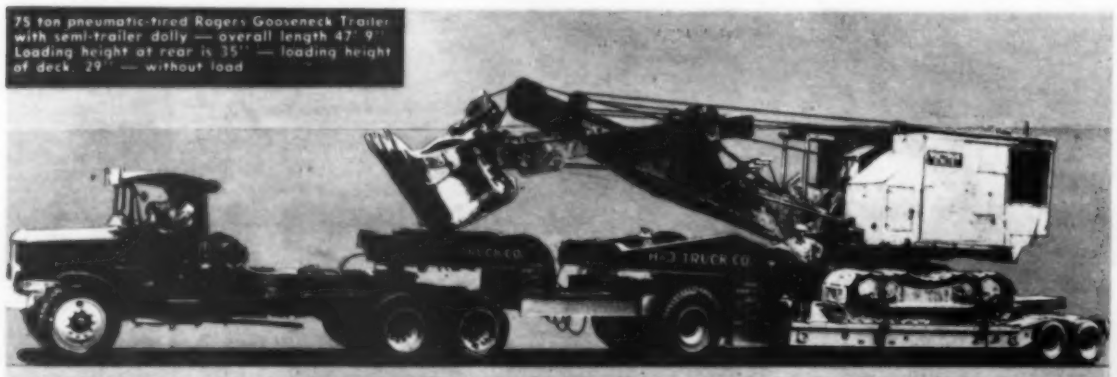
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